THE

FRANKLIN JOURNAL,

AND

AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE USEFUL ARTS, INTERNAL IMPROVEMENTS, AND GENERAL SCIENCE.

NOVEMBER, 1826.

FRANKLIN INSTITUTE.

At the late annual exhibition of American manufactures and inventions, a large model of an Inclined Plane, intended as a substitute for locks, in raising and lowering canal boats, from one level to another, was deposited by the inventor, Professor James Renwick, of Columbia College, New York. In order to insure that attentive consideration, which was demanded by the importance of the subject, it was referred to a special committee: the report of this committee, contains a view of the subject, so full and satisfactory, that notwithstanding its length, the publication of it, will, undoubtedly, be acceptable to our readers.

Report of the Committee of the Franklin Institute, on the Inclined Plane of Professor James Renwick.

The Committee have examined the plan proposed by Mr. Renwick, with all the attention which the importance of the subject, and the interest which it has excited, most justly required.

The expense of constructing locks on canals, the *difficulty*, and sometimes the *impossibility*, of supplying them with water, and the *delay* which always occurs in passing through them, have induced ingenious individuals, both in Europe and the United States, to suggest various substitutes, by which these difficulties might be lessened, although they could not be entirely removed.

The variety of these inventions has been as remarkable as their projectors have been numerous. A comparison, or even a description of their plans, could be comprised only in a volume; and our present limits will permit us only briefly to mention one or two which

are analogous, in some of their features, to the project at present under our consideration. We, therefore, beg leave to refer you to those works in which the plans of the following individuals, are described: Messrs. Anderson, Bossut, Brindley, Bridge, Chapman, Dukart, Forey, Fulton, Fussell, Gauthey, Green, Leach, Long, Luke, Pickering, Reynolds, Rowland, Salmon, Solages, Sothern, Weldon and White. Many of these plans have been practically tested; several have been attended with success; others with partial, or complete failure; and, of the remainder, some, although plausible in theory, have never been subjected to the ordeal of trial, in consequence of the indolence, or inability, of their projectors, or from the want of confidence in the public, respecting the practicability of the inventions.

The majority of these descriptions refer to perpendicular lifts, to alterations in the plans of locks, or to inclined planes. To the latter only, of these plans, we propose now to direct your attention. A great variety of these substitutes for locks, has been constructed in Europe, and two have been attempted in this country, one at Hadley and one on the Morris Canal; the latter, intended for boats of twenty-five tons; the majority of the former, for vessels of less burthen. The most important of these substitutes, exists in full and successful operation, on the canal of the duke of Bridgewater, at Worsley; the inclined plane is 453 feet in length, and the perpendicular height 106½ feet, and the inclination about one foot in four. The boats are placed on cradles; the total weight of both boats and cradles is forty-two tons. The effect is produced by the descent of the laden boats elevating on the plane, those which are empty, through the medium of a connecting cable, revolving on a drum. The boats are supported on the cradle during the operation; and, hence, this plan is not adapted for boats of large dimensions, which, if constructed in the usual manner, require the equal support of water to preserve them from injury, resulting from the strains, and concussions, to which they might otherwise be subjected.

The methods proposed by William Chapman, and, more particularly, the plan described in the patent of James Fussell, (see the Repertory of arts, vol. xi, page 12,) obviate this difficulty. In this, the boat is floated from the canal into a caisson or moveable lock, which is balanced by another caisson, in which a boat may also be placed; these are connected by means of chains, revolving on drums, placed at the extremity of the inclined planes or rail-ways, which are also double, and extend from the lower to the upper level of the canal. The descent of one of these moveable locks, in which the boat continues to float, necessarily occasions the ascent of the other. The power requisite for this purpose, is extremely trifling; for the friction of the wheels of the caisson on the rail-way, and of the gudgeons and chains, is the only resistance which it is necessary to overcome.

The foregoing plan, in all its leading features, is extremely similar to that of Mr. Renwick, which we are now about to investigate. We will first proceed to describe the ingenious plan of the latter gentleman, which appears to us to be superior to every method which we

have heretofore examined; to be perfectly practicable, and to possess many decided advantages over locks, and other devices, for overcoming elevations on canals. It is far less expensive, in construction, than locks, although it will be rather more expensive to maintain in repair; but this item of expenditure will be trifling, if we consider the great reduction in the expense which will result from the diminished number of superintendents which will be required. It requires a very small quantity of water to effect the transit of the boats, and one *remarkable* property of this plan, which we *particularly* submit to your attention, is, that *if the descending tonnage be one third greater than the ascending tonnage*, (and the proportion in this country has heretofore been much greater,) not only is *no water wasted*, by the transit of boats, but water will be actually *raised from the lower to the upper level* of the canal, even if the leakage from the gates and locks be considered: to accomplish this object, however, particular attention must be paid to the proper construction of the apparatus. This circumstance renders this plan of the greatest importance, particularly in the undulating, or mountainous, portions of the United States; for boats can be transferred, by means of this apparatus, from one level of a canal to another, with much greater certainty, rapidity, and economy, than by any other known method. We will not trespass on your time by dilating on the consequences of these highly important facts.

We will observe that no apprehension need be entertained respecting the perfect practicability of this plan. Many of its main features, have been practically tested in Europe; even the details have been separately subjected to experiment, but the happy combination of them, into one apparatus, was, for the first time, effected by the ingenious James Fussell, of England, (see vol. xi, page 12, Repertory of Arts, for a description of his patent.) The original project of this individual, has been slightly modified, and improved, by Mr. Renwick, who has, however, *added one essentially novel, and highly important improvement* to Mr. Fussell's ingenious plan, viz. the substitution of *two endless* chains, in place of *one single* chain; and a *new arrangement of the gearing of the drums, over which these chains revolve.* In this alteration, the merit, and the originality, of Mr. Renwick's plan consist; it cannot be doubted that this will materially increase the safety, and convenience, of managing the apparatus.

We do not, however, suppose that the additional chain, will assist *equally* with the first, in supporting the weight, although it may, occasionally, support the whole, in case of accident to the first chain; and will frequently support a portion of the load, particularly if the line of the rail-way be curved laterally. The chains will, also, be advantageous in preserving an equable motion in the locks, which travel on the rail-way, or inclined plane.

We will now insert Mr. Renwick's description of his plan, and the opinions held in relation to it, by some of the most eminent engineers in the United States. We have every reason to believe that the original plan of Fussel, which by the *important improvements* of Mr.

Renwick, has been rendered practicable, was entirely unknown to Mr. R. and to the United States Engineers, *at the time when the following reports* were written. In the letter of this gentleman to the committee, which is attached to this report, the claims of Mr. Fussel, to merit and originality, are contrasted with his own in a manner at once discriminating, candid, and ingenuous. The great similarity, therefore, of his plan, to that of the original inventor, Mr. Fussell, may be adduced as one of those coincidences in inventions, which men of genius, have, unknown to each other, frequently exhibited.

JAMES RENWICK'S DESCRIPTION OF HIS INCLINED PLANE.

I should propose to substitute two moveable locks, or vessels of wood, mounted upon triangular cheeks, in such a manner as to remain constantly horizontal, and moving on truck wheels, upon the iron rail-way. If the chains, suspending these, be so connected, that one shall be drawn up, by the descent of the other, the discharge of a small quantity of water from either, will set the apparatus in motion.

A basin, sixty feet in length, three feet in depth, and nine in width, will contain 45 tons of water, and the basin, with its carriage, wheels, &c. may probably weigh fifteen tons more; in all, sixty tons. If the number of truck wheels be eight, and one fourth be suspended by the chains, each will have five and two-third tons to support, and the weight will be distributed over sixty feet of the inclined plane. Axles of iron, to support this weight, need not be of any very great size. It may be inferred, from the experiments of Banks, that a bar of cast iron, an inch square, and supported by props distant one foot from each other, will support a strain of a ton weight; and an axle of three and one sixth inches in diameter, seven and a half tons. But the strength of good wrought iron, is, by the experiments of Muschenbrock, double that of cast iron: axles of wrought iron, of the above diameter, will, therefore, be amply sufficient.

In order to support the locks, chain cables, which are now manufactured at Dover, may be employed in lieu of those of hemp, which were used by the duke of Bridgewater. The weight of each basin and its appendages, being taken at sixty tons, forty-five will be supported by its pressure upon the inclined plane, and fifteen will remain to press upon the chains. Chain cables, made of inch iron, are subjected, at Dover, to a proof of eighteen tons. One of these may, therefore, be relied upon as a support; but if two be employed, the apparatus may be considered as beyond accident; for should one of the chains break, the other will support the load during the transit, while the precaution of having the chain cable made in lengths, and spare parts constantly at hand, will restore it, at once, to its original situation, before it can be exposed to any new strain.

As the motion would be accelerated, in some degree, by the unwinding of a great length of chain,* stoppers, similar to those employed with the chain cables on shipboard, should be provided; and,

* As *endless* chains will be employed in this apparatus, the acceleration will be occasioned by the *momentum* of the locks, and not from any *additional weight of the chains*, in descending; for this weight is a *constant quantity*, under all circumstances.—*Note of the Committee.*

as by means of them, any resistance, not capable of breaking the chains, may be overcome, the motion may be regulated, at will, to any degree of velocity. These stoppers will also be of use in another case that will be hereafter mentioned, and will serve to retain the car in close contact with the gates.

Where a cavity of fifteen feet in depth, can be excavated beneath the level of the bottom of the lower portion of the canals, and the water drained from it, either entirely, or in a great degree, the water of the lower level may be shut out by gates, similar to those that terminate the upper extremity of the inclined plane. In this event, the chains may be wound around a single horizontal shaft: those attached to one moveable lock, in one direction, and those attached to the other, in the opposite; the uncoiling of one pair, will, in that case, be accompanied by an equal involution of the other pair. But a position, affording this facility, will probably but seldom occur, and, therefore, an expedient of less simplicity, but of equal practicability, must be adopted. Each pair of chains must be wound around a separate shaft, and these must be so arranged, that they may act upon one another by the intervention of spur wheels; if one of the shafts have two wheels firmly fastened to it, with the number of teeth in proportion to each other, similar to that which exists between the total length of the inclined plane, and that portion of it which is above the surface of the water, in the lower reach of the canal, while two similar wheels are moveable, by means of a lever, upon the axle of the other shaft, in such a way that either may be connected at pleasure, with a wheel of a different number of teeth attached to the first shaft, it is obvious that, by such means, a velocity of motion may be given to the ascending lock, that shall draw it through the whole height of the inclined plane, during the time that the descending lock proceeds no lower than to touch the surface of the water, while the excess of water, in the descending lock, above the joint weight of a boat and its cargo, will furnish a sufficient moving power, except when the plane is very short. The stoppers that we have already mentioned, being now applied to the chains, the wheels may be thrown out of gear, and then by relaxing the pressure of the stopper on the descending lock, it may be permitted to sink gently into the cavity beneath the bottom of the lower level, into which the inclined plane must be extended so far as to permit the surface of the water, in the moveable lock, to become the same with that of the lower reach of the canal.

As the general aspect of the country presents every chance of finding favourable localities,* the inclined plane, itself, with its rail-ways, will be attended with but little difficulty. Supposing the ground to present the usual surface of boulders and gravel, this must be first smoothed to the proper angle, and excavated to a suitable depth, to admit the superstructure. Upon the ground thus smoothed and sloped, the foundation may be laid of fragments of stone and gravel, to the depth of eighteen inches; and it should be exposed, for a winter, to the effects of frost, in order that it may settle. Upon this founda-

* Mr. Renwick here alludes to the country traversed by the Morris Canal.—*Note of the Committee.*

tion are to be laid, at intervals of three feet, from centre to centre, blocks of stone, to support the rail-way: these should be, at least, eighteen inches in thickness, and weigh not less than 2 cwt. each. The plane of their upper surfaces may be brought nearly to the proper slope of wedges of stone, and must then be finished, and opened, by the chisel, to admit the rails. The intervals of the stones are then to be filled up with lesser stones and chips, and the whole smoothed into one regular plane surface; so that the rails may bear uniformly and equally in every part. The rails cast into the usual lengths of three feet, are to be fastened to the stones, laid and chiselled for the purpose, in the manner of a common rail-way.

Should, however, any doubt arise, although I entertain none, of the sufficiency of this method, which is the usual European mode of laying rail-ways, a small additional expense will place the structure beyond the reach of suspicion; let each of the outer rails be laid upon a firm wall of masonry, and a similar, but thicker wall, laid to support the two inner rails. The intervening space may be filled with chip stone, or may have a wooden channel laid in, to carry water to the lower levels.

Estimate of the cost of an inclined plane of 100 *feet descent.*

Excavation	2000 yards, at	12½ cents,	- -	$250 00
———	1500 „ „	25 „	- - -	375 00
Stone and gravel	1100 „ „	37½ „	- -	412 50
Stone	2200 „ „	1 25 „	- - -	2750 00
Chiselling and drilling 626 stones,		- - - -		313 00
Wall at foot of plane, 800 perch, at		$1 50,	- - -	1200 00
Walls at head of plane, 184 „	„	2 50,	- -	460 00
Timber 1200 feet, at 6 cents,		- - - - -		72 00
Plank 2000 „	„ 3 „	- - - - -		60 00
Laying foundation,		- - - - - - -		132 00
				$6024 50
Two gates at head of plane,		- - - - -		150 00
Two moveable locks, plank, timber, and carpenter's work				600 00
				$6774 50

Iron Work.

Rail way, 640 yards, 1 cwt. per yard, 32 tons, at 80 each,	$2560 00
Fitting and laying, do. - - - - - - -	440 00
Chain cables, 4 of 80 fathoms each, at 56 pounds per fathom, 8 tons, at $200 per ton, - - - - - -	1600 00
Cast iron wheels, 16 of 1 cwt. each, at $80 per ton, -	64 00
Wrought iron axles, 8, 2000 lbs. at 8 cents per lb. -	160 00
Spur wheels, 4, 8 cwt. at $6, . - - - - -	48 00
Gudgeons and sockets, $50—fitting, $150, - - -	200 00
	$5072 00
Two shafts, - - - - - - - - - -	50 00
	$11,896 50

Brought over, - - - -	$11,896 50
Should the rails be supported on walls of masonry, the estimate will be,	
1400 perch of masonry, at $2 50, - - - - -	$3500 00
1370 cubic yards of chip stone, at $1 25, - - -	1712 50
Instead of 2200 cubic yards, at $1 25, - - - -	5212 50
	2750 00
Making an addition of - - - - - -	2462 50
Total, - - - - -	$14,359 00

Say $150 per foot of descent.

EXTRACT FROM THE OPINION OF BENJAMIN WRIGHT, CIVIL ENGINEER.

"The great elevation above tide-water, which it is proposed to carry this canal,* would at first view, appear a heavy item of expense, provided this elevation was to be overcome by locks exclusively, built after the manner of those on the Erie Canal. Happily, however, James Renwick, Esq. of Columbia College, has projected, and nearly matured, a plan of rising, or falling, from one level to another, by means of inclined planes, to be erected at all eligible and favourable positions, to overcome 1400 feet of ascent and descent, and the remainder to be conquered by locks of various lifts, to be constructed of hammered stone, and made upon the most economical plan, and durable construction. Mr. Renwick has explained to me the plan, and operation of his inclined plane, in his report on the subject, and in our several interviews, and has satisfied me of the practicability and utility of adopting it, as a great saving in expense, in water, and in time, upon the proposed canal, and I feel the greatest confidence in its successful operation."

EXTRACT FROM THE OPINION OF GEN. JOSEPH G. SWIFT, OF NEW YORK.

"Much time has been occupied in devising a plan to pass the highlands; for the hill opposed appalling difficulties to mere lock navigation. Your invention of a new adaptation of the inclined plane, has, in my opinion, given means to obviate this difficulty. I am glad to learn that Gen. Barnard, and Col. Totten, coincide with me in this opinion; I have examined the subject with some care, and am entirely satisfied that the planes can be easily constructed, and that they would be safe, and sure."

(TO BE CONTINUED.)

* The Morris Canal, New Jersey

Abstract of the report of the Committee on Premiums and Exhibition, on the subject of the third annual exhibition, and of the premiums awarded.

The third annual exhibition of American Manufactures, was held at the Masonic Hall, on the 3d, 4th, 5th, and 6th October.

Of the sixty-three premiums offered by the Institute, twenty-four were claimed, and fourteen awarded to successful competitors.

The committee regret that the number of premiums claimed was so limited, but express their satisfaction at the rapid advancement our manufactures have made towards perfection, within the last year, of which, the recent display afforded abundant proof.

Among the various branches which might be selected in support of their observation, they especially notice the cut glass, cabinet furniture, musical instruments, mantles, grates, lace, straw bonnets, leather, and particularly a large collection of china, from Jersey City. Although they withhold their unqualified praise, from this collection, they congratulate their fellow citizens on the evidence now presented, that America is able to supply herself with this important product, and to look forward to a day, not very far distant, when this country will be no longer tributary to foreign manufacturers, for the supply of these articles.

As it was altogether impossible for the committee to enter into a detail of all the numerous specimens exhibited, they reserve this for a future report, and content themselves with an enumeration of those to which the premiums are due, and which they have thought worthy of particular commendation.

The premium to the maker of the best specimen of soft iron castings, fit for small machinery, is awarded to Dean Walker, Savage Factory, near Baltimore, for a box of machine castings, which were, in the opinion of the judges, superior to any they had ever seen:—The silver medal.

To the maker of the best constructed stove, or grate, for burning anthracite, for domestic purposes, and, which will unite convenience with economy, is awarded to Mr. Joseph Page, Philadelphia: his stove is simple in its construction, and contains all the required conveniences:—The silver medal.

To the maker of the best flint glass-ware: awarded to J. L. Gilleland & Co. of Brooklyn, New York. This premium was offered for the quality of the material, and the form of the article, and not for the cutting; and the judges report, that among all the specimens made by these gentlemen, they could not perceive one bad piece:—The silver medal.

To the makers of the best red earthenware: awarded to Thomas Haig, Northern Liberty Pottery, Philadelphia. The specimens exhibited much improvement in the art:—The bronzed medal.

To the maker of the best china, from American materials; awarded to the New Jersey Porcelain and Earthenware Company. The makers are entitled, by the proposal, to the bronzed medal; but, in con-

sideration of the great importance of the object, the committee have awarded—The silver medal.

To the manufacturer of the best piece of black broad cloth, awarded to J. M. Robbins, Watertown, Mass.:—The silver medal.

For the best specimen of skirting leather, tanned and dressed in Pennsylvania, awarded for three bundles manufactured by Wm. Linvill, Lancaster county, Penn.:—The silver medal.

To the maker of the best japanned leather, made in the United States, awarded to Street & Foering, Philad.:—The bronzed medal.

For the best cabinet secretary and book-case, awarded to Charles H. White, Philad.:—The silver medal.

To the manufacturer of the best white lead, 50 lbs. exhibited, assurance given that 20 tons of the same quality and price will be furnished, awarded to Samuel R. Wood, Norristown, Penn.:—The silver medal, when the conditions of the premium are fulfilled.

For the best specimen of lithography, executed in the United States, awarded to W. & J. Pendleton, Boston:—The silver medal.

To the maker of the best pair of marble mantles, of Pennsylvania marble, awarded to Lewis Stegagnini, Philadelphia, for a pair of double column mantles, Henderson's marble:—The silver medal.

To a pupil of the Drawing School, for the best specimen of drawing, awarded to Mr. Andrew Young, of Flat Rock, Pennsylvania, for four specimens of geometrical and perspective drawing, the result of one winter's study, at the school of the Institute:—The silver medal.

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In accordance with the reservation of the right of awarding such premiums, or compliments, for articles not enumerated in their proposed list of premiums, as may, in the opinion of the committee, be deemed worthy of them, they have, with the advice of the judges, made the following awards.

To Professor James Renwick, of New York, for his improvements in the inclined plane:—The silver medal.

To Anthony G. Quervelle, Philad. for a mahogany sideboard, with white American marble cover:—The bronzed medal.

To John Steele, of Philadelphia, for two pieces of gingham:—The silver medal.

Striped and twilled goods were presented by Joseph Ripka, of Philadelphia, which were also very superior, and would have received an honorary medal, had he not been a member of the committee of judges.

To H. Whitaker, of Cedar Grove, near Philadelphia, for three pieces of bang up cords:—The silver medal. The judges report, that the novelty of this manufacture, and its excellence, entitle the manufacturer to the particular notice of the Institute.

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The committee award *honorary mention*, to the makers of the following specimens.

To John Ashburner & Son, of Philadelphia, for thirty sides of slaughter sole leather, which is uncommonly good, and entitled to special notice.

To Cyrus Jacobs, of Lancaster county, Pennsylvania, for five bars of iron, all remarkably well drawn, and of excellent quality. That marked Pool forge, was the finest.

To F. W. Widmann, of Philadelphia, for two swords, manufactured by him. They reflect high credit on the maker.

To Lloyd & Sons, of Philadelphia, for a coal grate.

To Samuel P. Griffitts, of Philadelphia, for a roll of adhesive plaister, on muslin. This plaister was spread by Mr. Griffitts, on machinery of his own invention. It is equal to the imported, and deserves to be introduced into general use.

To McLord & Shiner, Philadelphia; Jackson and Baggot, New York; the New England Glass Company; Bakewell, Page & Bakewell, Pittsburg; and G. Dummer & Co. Jersey City, for the splendid collection of cut glass. The judges report that these articles, are so well, and so extensivly made, as to prove, beyond all question, that this country need not remain tributary to foreign manufacturers; and they state, without hesitation, that there was not an article exhibited, that would not do credit to any foreign establishment. The premium being offered for the glass only, they were relieved from the delicate and difficult task of discrimination.

To George Armitage, Philadelphia, for five pair of plated mugs, equal in taste of design, and in workmanship, to the best imported ware. These are the first articles of the kind made in the United States, that ever came to the knowledge of the judges.

To J. Graham, Philadelphia, for a secretary. This is an excellent sample of well finished work.

To C. A. Morris, York, Penn. for a piece of Venetian carpet, made in the family of Mr. Morris.

To J. M'Cauley, Philadelphia, for a painted floor cloth, 60 feet long, and 21 in width; also, five pieces of patent oil cloth. The specimens presented, were equal, if not superior, to any imported.

To Blanchard, Haley & Beaty; and A. Y. Humphreys, for specimens of paper hanging. The manufacture of paper hanging, now rivals any foreign competitors. The samples produced, were highly creditable to the makers.

To Christian Gobrecht, for the medal dies of the Institute, cut by him. The judges have recommended these dies as deserving special commendation. The head of Franklin is correctly drawn, and well chiselled, the forehead, in particular remarkable for its truth, and neatness of execution, and the expression of the countenance well preserved.

To Thomas Harrison, Philadelphia county, for a box of rose pink, of a very superior quality; to M'Kim, Sims & Co. Baltimore, for Prussian blue, the best exhibited; and to J. Boston, Philadelphia, for a very superior sample of lake carmine.

To Jos. Saxton, of Philad. for his compensating pendulum. This ingenious contrivance consists of a rod of steel enclosed in two tubes, one of steel, the other of zinc, so arranged that while the expansion of the steel tends to lengthen the pendulum, the zinc shortens it, and these two effects exactly counterbalance each other. The arrange-

ment of this tubular pendulum, and the method of adjustment, are new, and entitle Mr. Saxton to honorary mention.

To Peter Kennedy, Philadelphia, for a door lock.

To Mason and Baldwin, Philadelphia, for a slide rest, and an engraved copper cylinder, for calico printing, both made by them.

To John Bancroft, Delaware county, for four pieces of flannel.

To Kershaw & Dean, Pennsylvania, for two blankets. These blankets were of a very superior quality, and the committee would have gladly awarded the premium, had the conditions been adhered to: one dozen pair should have been exhibited.

To Daniel Bulkley, of Hampton, Conn. and to J. Fitch, ———, Conn. for sewing silk; a very superior article, not surpassed in quality, or colours, by the best Italian silk.

To J. Read, of New York, for silk vesting and ribands.

To Christian Cornelius, of Philadelphia, for a large chandelier. A beautiful specimen of workmanship, entitled to great praise, particularly for the fine colour of the lacker.

To John Struthers, for a mantle of Italian marble. This beautiful specimen of work, could not come into competition, by the terms of the proposal, as the material was not Pennsylvanian; it reflects the highest credit on the maker, for taste of design, and excellence of workmanship.

The highest praise is also due to Messrs. Loud & Brothers, of Philadelphia, and Dubois & Stodart, of New York, for their upright pianos, the latter made by R. & Wm. Nunns. The committee agree that these instruments were decidedly the best at the exhibition, but are divided in their judgment as to which of the two, ought to have the preference. The tone of each was very pleasing, distinct, and full.

To Hannah Smith, teacher of the Walnut street school, Philadelphia, and Eliza Bennet, of Massachusetts, for a straw bonnet each; pronounced very superior, and deserving particular notice. Also, to Joseph Belcher, of Berkshire, Tioga county, New York, for a Leghorn bonnet, price $25; in fineness of plait and sewing, and in richness of colour, rarely surpassed by imported bonnets, at any price.

To J. L. Sullivan and David Clarke, for patent bound blank books, well made, handsome, and durable.

To Eldridge & Brick, for very superior waxed calf skins.

To A. Atkinson, for three saddles, very splendid and superior articles.

To Henry Huffman, foreman of Henry Apple, for a 66 gallon cask.

The aquatint, of Doughty's picture of Fair Mount Water-works; by Hill, the likeness of Chief Justice Tilghman, by Bridport, and the plates for Carey & Lea's Souvenir, by Ellis, Longacre, Kearney, Maverick and Childs, are all executed in a manner highly creditable to the artists. The presentation plate to the same work, exhibits the ingenuity of Mr. Gobrecht in a department new in this country, and which will be an appropriate ornament.

Gilt buttons from the manufactories of A. Goodyear & Son; Leavenworth, Hayden & Scovill; Lewis, Grilly & Lewis, of Waterbury,

Conn.; R. Robinson & Son, of Atleboro', Mass. and George Armitage, of Philadelphia, deserve, from their excellence, to supersede any that are imported. The improvement in this article, within the last year, is particularly noticed.

The committee close their examination with making special mention of various other articles, which they deem justly worthy of notice, and which we very unwillingly omit, from an apprehension that the whole list might be thought to occupy too large a portion of the Journal.

Notwithstanding the immense crowd of visiters that thronged the Hall, during the first three days, which was computed by actual count, at different times, to be about thirty four thousand, not a single article was missed, and, it is believed, nothing materially injured. The committee have great satisfaction in being able to announce this fact, both for the credit of the city, and to dispel a report which had arisen, that some valuable articles had been clandestinely removed.

QUARTERLY MEETING OF THE FRANKLIN INSTITUTE.

At a Quarterly meeting of the Franklin Institute, held at the Hall, October 16th, 1826, James M'Alpin, was appointed President *pro tem.* and Dr. Thomas P. Jones, Secretary *pro tem.*

The eleventh Quarterly report of the Board of Managers was read, accepted, and ordered to be printed.

On motion resolved,—That the thanks of the Institute be presented, and they are hereby presented, to the Board of Managers, for the faithful and able manner in which they have discharged their duties; and particularly for the zeal evinced by them in the successful establishment of the High School.

Resolved,—That the Institute have heard with peculiar pleasure, of the donation by our fellow citizen, Dr. John Redman Coxe, of an electrical machine which formerly belonged to the immortal Franklin;—a donation which is the more valuable, as it may tend to cherish by the presence of a sensible memorial, a vivid recollection, not only of the general scientific merits, but also of some of the peculiar attainments, of that great philosopher.

Resolved,—That General Stephen Duncan, Walter R. Johnson, and George W. Smith, be appointed a Committee, to wait on Dr. Coxe, with a copy of the foregoing resolution.

Resolved,—That the thanks of the Institute be presented to Turner Camac, Esq. for his liberality in presenting a copy of that rare and valuable work, Langley's Architecture, and that the same committee be requested to carry this resolution into effect.

Resolved,—That the Society have seen with regret, that the Franklin Journal, published under the auspices of the Institute, has not been supported by its members, and by the public, with that liberality to which it is entitled, by its pre-eminent usefulness, and the science and zeal displayed by its Editor;

Therefore resolved,—That this meeting will use every endeavour

to increase the circulation of a work, the discontinuance of which, would injure the character of Philadelphia.

Resolved,—That this meeting recommend to the Board of Managers, of the Institute, to consider the propriety of holding a Quarterly meeting of the Society, immediately after the delivery of the medals.

JAMES M'ALPIN, *President pro tem.*

THOMAS P. JONES, *Secretary pro tem.*

Eleventh Quarterly Report of the Board of Managers of the Institute.

To the Franklin Institute of the State of Pennsylvania, the Board of Managers present their eleventh Quarterly Report.—The Board of Managers in their last Quarterly Report to the Institute, noticed the arrangements which had been made, for carrying into effect, the resolution for the establishment of a High School, to be under the patronage of, and attached to the Institute. This School was opened at the period contemplated, and under auspices the most gratifying to its founders. Within a few days from its commencement, upwards of three hundred pupils were admitted, and could a greater number have been accommodated, they might have been obtained. From the decided approbation of the plan of the School, which the public has thus distinctly manifested, and from the manner in which this department has been hitherto conducted, the Board feel perfectly assured of the utility, and the permanence of the establishment. The School has been in operation for so short a period, that no official report, respecting its progress, has yet been made by the Committee of Instruction; but, it is known to be under contemplation, to extend its benefits to a greater number of pupils, when suitable premises can be procured. This, when accomplished, will leave that part of the Hall now occupied by the School, to be appropriated to the uses for which it was originally intended.

The Evening Schools for Drawing, and for Mathematics, have recommenced, under the same able instructors by whom they have been heretofore conducted.

Some unexpected delay has taken place in the finishing of the new Hall; the Board, however, have adopted such measures, as will insure its completion, and prevent all the inconvenience which this delay might otherwise have occasioned.

The Hall will be opened, preparatory to the delivery of the courses of lectures, for the ensuing winter, on the 6th of November, when an address will be delivered there by professor Patterson. Professor Jones will commence his course of lectures, on practical Mechanics, on the 7th of the same month, and will continue to lecture on every succeeding Tuesday. Dr. Franklin Bache, has been appointed to lecture upon Chemistry, as applied to the arts, in the place of professor Keating, who is absent; this course will be delivered on Thursdays, commencing on the 9th of the month. Saturday evenings, have

been reserved for volunteer lectures.—Dr. Godman, the professor of Natural History, has obtained leave of absence for the season.

The Annual Exhibition, commenced on the 3d inst. at the Masonic Hall, and was continued for four days. The reports of the respective committees, appointed to judge of the articles exhibited, will be published; the Board, however, deem it proper to remark, that the beauty and excellence of many of the manufactures, were such, as not only to produce general satisfaction, but greatly to surpass the expectations of the most sanguine. The intense interest excited in the public mind, was strikingly manifested by the crowd of visitants which continued during the whole period of the exhibition, and, also from the opinions expressed by those who are competent judges. The number of inferior articles of manufacture, was not so large as at the preceding exhibition, but the great progress which had been made during the last year, was strikingly exemplified in the general superiority of the fabrics, and in the production of new articles of manufacture.

The arduous duties devolving upon the committee of premiums and exhibitions, the committee of arrangement, and those appointed as judges of the various articles, were performed with a degree of zeal, and ability, which justly entitle the members of them, to the gratitude of the Institute.

The medals, which have been awarded, were delivered to the successful competitors, on the 14th instant. In several instances, in which the excellence of the manufactures, would have entitled them to a premium, it was necessarily withheld, in consequence of the conditions not having been complied with, on the part of the manufacturer.

There has been a considerable accession of new members since the last report; and the approaching season, for the delivery of the lectures, will undoubtedly add to the number. The library, the cabinet of Minerals, and the apparatus, have received some additions; in the latter, we may particularly mention a donation from Dr. John Redman Coxe, of the Electrifying machine, upon which the original experiments of Dr. Franklin were performed; and, in the former, Langley's Architecture, in large folio, with 494 plates, presented by Turner Camac, Esq.

Measures have been taken, which will probably eventuate in the annexing a very valuable cabinet of Minerals, to those now in our possession.

The Franklin Journal, conducted by the Professor of Mechanics, continues to sustain its reputation; but, the Board regret to learn, that it has not received that support from the members of the Institute, which was anticipated, and which the work so justly merits.

With the termination of the year, for which the Board was elected, a detailed statement of the fiscal concerns of the Institute, will be exhibited. Some temporary difficulty will be experienced, from the diminution of the receipts, consequent upon the alteration of the time for receiving the annual payments from members, as it is upon this fund, that we principally depend for meeting our current expenses. This difficulty will be greatly lessened, if not altogether re-

moved, should those members, who at present are in arrears, make immediate payment.

All which is respectfully submitted,

By order of the Board of Managers.

WILLIAM MILLER, *Chairman pro tem.*

JOHN R. WARDER, *Clerk.*

Philadelphia, October 19th, 1826.

MECHANICAL JURISPRUDENCE, No. X.

BY PETER A. BROWNE, ESQ.

On the Law of Patents for New and Useful Inventions.

Having, in the last essay, treated on the first qualification of a valid patent, I now come to the second; that of being *new*. The law not only requires that the patentee shall be the inventor, but, in England, he must be the FIRST and TRUE inventor; in the United States, he must be the TRUE and ORIGINAL inventor. The laws of both countries admit, what experience teaches, that there may be two, or more, inventors or discoverers of the same thing: and, as by the laws of both the countries, there can be but *one* valid patent for an invention or discovery, the question often occurs, which among them is the *first* and *true*, or the *true* and *original* inventor.

Among inventors, who have reduced their inventions to practice, he who is *first in point of time*, is preferred by the law. This was decided in the case of Lewell *v.* Lewis, 1 Mason's Rep. 182. In the year 1813, Jacob Perkins obtained a patent for a new and useful invention, in the construction of pumps, and assigned his interest to the plaintiff. James Baker, in 1817, obtained a similar patent, which was assigned to the defendant.

Judge Story, in his charge, said, "If they (the machines) are the same invention, then Mr. Perkins, being clearly the *first* inventor, is entitled exclusively to the patent right, although Mr. Baker may have been also an *original* inventor, for the law gives the right, among inventors, to him, who is the first in time."

It is worthy of a passing observation, that the above preference is not founded on the construction of the word *original* in the act of congress, which is substituted for the word "first," in the British statutes, since Judge Story speaks of both being *original* inventors.* But, the *first* inventor, in point of time, must, in order to entitle himself to a preference, reduce his invention to practice; for it is not he who confines his invention to his closet, but he who reduces it to practice; who takes out a patent, and makes it public, within a reasonable time, that the law prefers.

* If the above is, as it is supposed to be, a correct statement of the law, the person, who has discovered a new and useful invention, must not be satisfied with the consciousness of having been the original *bona fide* discoverer, he must institute the enquiry, whether some other more fortunate individual may not, at an anterior time, have made a similar discovery.

One Hall discovered a new method of making the object glasses of refracting telescopes, by compounding fluids of different refractive qualities, but he did not make his discovery public: one Dolland having made the same discovery, took out a patent, and the question was, whether Hall, or Dolland, was the *first* and *true inventor*, within the meaning of the British statute; and it was decided in favour of the latter. This case is mentioned by Buller J. in pages 470 and 487 of 2d Hen. Blackstone's Reports.

The same point came before the Circuit Court of the United States, for the first circuit, in 1813. Woodcock sued Parker, for a breach of a patent, for splitting leather. The plaintiff's patent was dated the 8th May, 1809; the defendant claimed, under another, Parker, whose patent was dated the 9th July, 1808; the question was, whether Woodcock, or Parker, was the *first* inventor. Story J. observed, that the first inventor is entitled to the benefit of his invention, *if he reduce it to practice, and obtain a patent therefor*, and a subsequent inventor cannot, by obtaining a patent therefor, oust the first inventor of his right, or maintain an action against him, for the use of his own invention. See 1. Gallison's Reports, 438.

It is a well settled principle of law, that if the inventor of a machine, &c. absolutely abandons his right to take a patent, it becomes public property.

In the case of Evans *v.* Eaton, 1st Peter's C. C. Rep. 348; it appeared, that the plaintiff sued for a violation of his patent right to an improvement in the art of manufacturing flour, &c. by means of certain machinery, among which was a hopperboy. The defendant produced several witnesses, who described a machine, called Stouffer's machine, or hopperboy, similar to the plaintiff's, which had been in use in many mills from the year 1764.

Judge Washington observed, "The last point is, that Stouffer's invention was abandoned, and consequently might be appropriated by the plaintiff. The principle may be admitted, but not the conclusion. If Stouffer was the original inventor of the hopperboy, and chose not to obtain a patent for it, *it became public property by his abandonment*. He could maintain no action against any person for using it, nor could any other person obtain a patent for it, because he would not be the original inventor.

In like manner, in the case of Whitemore *v.* Cutter, 1 Gallison's Reports, 478, Judge Story declares, that if the original inventor of a machine, &c. suffers it to be freely and fully used by the public at large, for such a length of time, that this devotion to the public use can be fairly inferred, he cannot afterwards resume the invention, and take out a patent.

What circumstances will be evidence of an abandonment, and what length of time the inventor may allow to elapse, without taking out a patent, and without losing his right, are questions not so easily decided, as will appear from the following cases.

A case of Evans v. Weiss, is mentioned in Fessenden, on Patents, page 52. The plaintiff was the inventor of an improvement in the manufacture of flour, and the patent-right to the same, theretofore

obtained, having been adjudged void, and the time for which the said patent was granted, having, also, run out, an act of Congress was made for the plaintiff's relief; notice of which was given to the defendant. During the continuance of the former patent, the defendant purchased of the plaintiff, a right to use the improvement, at his mill, for one wheel and pair of stones; but, prior to the passing of the act of Congress, he had applied and used the same, for two wheels, and two pair of stones. The questions submitted, were, whether the defendant was liable for damages, for the use of the said improvements, in application to this second wheel and pair of stones, after the passing of the act of Congress; and, if so, whether he was liable before notice from the plaintiff.

In delivering the opinion of the Court, Judge Washington is represented to have uttered the following sentiments, viz. "It must be confessed, that cases of great hardship may occur, if, after a man shall have gone to the expense of erecting a machine, for which the inventor has not then, and never may obtain a patent, he shall be prevented from using it, by the grant of a subsequent patent, and its relation back to the patentee's prior invention. But the law, in this case, cannot be termed *ex post facto*, or even retrospective, in its operation; because the general law declares, beforehand, that the right to the patent belongs to him, who is the first inventor, *even before the patent is granted;* and, therefore, any person, who, knowing that another is the first inventor, yet doubting whether that other will ever apply for a patent, proceeds to construct a machine, of which it may afterwards appear, that he is not the first inventor, acts at his peril, and, with the full knowledge of the law, that by relation back to the first invention, a subsequent patent may cut him out of the machine thus erected.

"Not only may individuals be injured by a liberal construction of the words in the law, but, the public may suffer, if an obstinate, or negligent, inventor, should decline obtaining a patent, and, at the same time, keep others at arms length, so as to prevent them from profiting by the invention, for a length of time, during which, the fourteen years *are not running on.* But, these hardships must rest with Congress to correct. It is beyond our power to apply a remedy."

And it would seem, from the case of Pettibone v. Derringer, which was tried before Justice Washington, in May, 1818, that he did not *then*, consider this point as entirely settled. It was an action brought for the recovery of damages, for an infringement of a patent, for a new and useful improvement in musket, pistol, and rifle barrels, by an auger, called the spiral groove, or twisted screw auger. The plaintiff gave in evidence, a letter from himself to the Secretary of State, dated 21st January, 1799, containing a specification of an improvement in boring muskets, and agreeing, in every material circumstance, with that annexed to his present patent, except that he states the augur used, to be one called the nut bit, invented by M'Cormick. In this letter, he claims to be the inventor of the improvement, and claims a patent for the same. He, also, gave in evidence,

a similar application to the Secretary of State, dated 12th August, 1799, accompanied by a similar specification, except, that this speaks of, and describes, the twisted screw auger, as his invention. Both specifications are accompanied with the usual affidavit.

The tendency of the plaintiff's testimony, was to prove, that he was the first inventor of the twisted auger, for boring musket, pistol, and rifle barrels; that he was, also, the inventor of the mode of *drawing*, instead of *pushing*, the auger through the barrel, and of the application of the endless screw, to produce that effect; and, also, of the superiority of his invention, to the former modes of boring gun barrels.

The defendant examined a number of witnesses, to prove, that the plaintiff was not the inventor of the screw auger, nor of the mode of drawing the auger through the barrel, but that both had been invented, and used, before the plaintiff pretended to have invented either; and, also, that the difference between M'Cormick's auger, which the plaintiff acknowledged to have been used before January, 1799, and the screw auger, of which he claimed to be the inventor, in August, 1799, was not a difference in principle, but in form only. Also, that M'Cormick's auger was preferable to the plaintiff's, and was more generally in use, in the public manufactories of arms.

The counsel for the defendant argued, that the delay of the plaintiff, to secure his invention, (if he was the inventor,) from 1799, to 1814, was an abandonment of all benefits, and privileges, proceeding from it; and that, having thus avoided his right, he could not afterwards reclaim it.

Judge Washington, on this point, charged the Jury, as follows. "The defendant's counsel, have presented to the consideration of the Court, another ground of defence, which is equally new and embarrassing. It is, that although it appeared that the plaintiff was the first inventor of the improvement, which he claims, still, he ought to be considered as having abandoned it to the public, and, consequently to have lost his right to a subsequent exclusive appropriation of it. The ground upon which this argument rests, is an implied abandonment, or waiver, of the plaintiff's right, in declining to take out a patent until 1814, for a discovery, asserted to have been made in 1799. Whether such a waiver can, under any circumstances, be presumed, from the mere fact of the loss of time, between the discovery, and the date of the patent, is a question of great importance. If it cannot, then the law ought to provide for such a case, by limiting the legal effect of the discovery, either to the date of the patent, or to such prior period, as the legislature, in its wisdom, may think just. For if the patent, may relate back to the discovery, however remote, it is most obvious, that the inventor possesses to a certain degree, all the rights of a patentee, in addition to those rights, which are secured to him by the patent. For in the case of costly machinery, what man would venture to construct, and use it, without the permission of the inventor, and without purchasing from him that permission, if the inventor might, at any time afterwards, take out a patent, and forbid the subsequent use of it. Thus the inventor, may hold all the world

at arms length, as long as he pleases, and enjoy, to a certain degree, the fruits of his discovery, during all that time, and finally secure the right in its full extent, for fourteen years more, by obtaining a patent."

In the case of Huntington *v.* Morris, M. S. Rep. of the C. C. U. S. for the Southern District of New York, Judge Thompson having decided, that the discovery should be unknown, and not used, as the invention of *any other than the patentee*, before the application for a patent, adds, "I am aware that evils might exist under this construction; expensive machines might be made before a patent should be taken out, and persons, who had innocently engaged in expenses in this way, stopped short; but, I incline to think, that, under such circumstances, a patent would not be permitted to operate to the prejudice of persons thus situated, on the principle, that innocent third persons should not be injured by relation back, so as to deprive them of a right, lawfully acquired; and, that if a person knowing of an invention, proceeds to put it in use, the inventor not having secured his right by patent, the latter ought not to be permitted to take away that which had been previously lawfully made. That no man should be permitted to lay by for years, and then take out a patent: but that if he was practising his invention, with a view of improving it, and thereby rendering a greater benefit to the public, before taking out a patent, that should not prejudice him."

Supposing lapse of time to be presumptive evidence of an abandonment, another question will occur, namely, what act of the inventor shall amount to a rebuttal of this presumption.

Judge Washington, in the case above cited, notices this question, in the following manner. "Another question in this case, and under this head, is, whether abandonment, if it can be presumed at all, is repelled by the circumstance of a claim to this discovery having been filed in the department of state, and subsequently renewed, in the way of continual claim? This was done by the present plaintiff, in 1799 and 1812. If it can, it must be admitted, that the inconveniences to the public, which are before pointed out, are not at all removed, or diminished, by such a course of proceeding. Upon these points, the court would not wish to express an opinion, unless it shall be insisted on by the counsel, on either side, and if it be, we shall not withhold it."*

Whether the party has abandoned, or not, is a question of intention, to be left to the jury.

Huntington *v.* Morris, M. S. C. C. N. Y. Rep. Judge Thompson. "It should always be a question submitted to a jury, what was the intent of the delay of the patent, and, whether allowing the invention

* I take the liberty here, of recommending to those who have made, or shall hereafter make, new and useful discoveries, to delay taking out their patents, no longer than shall be absolutely necessary to make those prudent enquiries which ought to precede every application for a patent. By so doing, they will avoid the risk of having their exclusive privilege called in question, on the ground of abandonment.

to be used without a patent, should not be considered an abandonment, or a present of it, to the public."

In an action for the violation of a patent, if the ground of defence be, that the plaintiff is not the original inventor, he must come to the court prepared to prove that fact. This was established in the case of Evans *v.* Kremer, 1. Peters' C. C. Rep. 215.

But slight proof is all that is required in the first instance. Turner *v.* Winter, 1. Term. Rep. 602.

FOR THE FRANKLIN JOURNAL.

*On the employment of fatty substances, for impregnating stone and plaster, in order to render them water tight, and also for making damp places, dry and salubrious. Abstracted from a memoir, by Messrs. D'Arcet and Thenard, published in the Annales de Chemie, for May last.**

The observations which gave rise to this memoir, were commenced in 1813; at this period, Messrs. D'Arcet and Thenard were consulted, respecting a composition, with which it was contemplated to cover the cupola of the Church of St. Genevieve, in order to render it impervious to water. A little reflection convinced them, that the best mode, would be to fill the pores with some fatty matter, which might be liquified by heat, and which would be solid, when cold. This conviction was strengthened by the fact, that the ancients sometimes melted wax, upon walls which they intended to paint. It was concluded therefore, that a mixture of yellow wax, and linseed oil, rendered drying, by litharge, would answer the purpose. One part of wax, was melted in three parts of linseed oil, which had been boiled with one tenth of its weight of litharge. On taking a piece of the kind of stone of which the cupola was built, which appears to have been rather soft and porous, it was found to imbibe the mixture readily, when heated, and that when cooled, it had increased in solidity, and after a lapse of six weeks, or two months, it had attained a considerable degree of hardness.

The preceding trial having been made, it was determined to apply the composition to the cupola; this was effected by scraping off the materials, with which it had formerly been covered, so as to leave the stone perfectly clean, which was then heated, by means of a very large chafing dish: a space somewhat more than a yard square, was thus brought to a temperature, about equal to that of boiling water; the composition was then applied, by means of large brushes, taking care that the saturation should be perfect; to insure this, it was found

* In our last number, we gave a notice of the processes described in this paper. We have abridged the details given in the original memoir, so as to reduce it about one half, but have been careful to retain whatever appeared of importance. The degrees, weights, and measures, have been changed, for such as are in general use, in this country.—*Editor.*

necessary to operate upon some parts, two or three times, according to the porosity of the stone. The higher the degree of heat produced, the more perfect was the work, provided it was not sufficient to effect the burning of the oil.

After the cupola had been completely covered, and the composition had been allowed to harden, it was painted over with white lead and oil; this served as the ground-work for one of the finest productions in the arts, from the pencil of M. Gros; and which it is not doubted, will be equally durable with the dome itself, as it has now undergone the trial of eleven years, without the slightest alteration, excepting that which air, and light, necessarily produce on the colouring. The picture has not required any coating with varnish, as the ground entirely forbids the *sinking* of the oil.

The composition was afterwards applied to other compartments of the building, with equal success; in some instances, in which the stone was extremely hard, it was found to have penetrated to the depth of about one-seventh of an inch.

The same preparation was afterwards tried upon articles made of plaster of paris. Two specimens were exhibited, by Messrs. D'Arcet and Thenard, one half of each of which, had been impregnated with the composition, and the remainder left unprotected. These had been left for a very considerable length of time, under gutters; the defended parts remained entire, whilst the other portions were powerfully acted upon by the water, being extremely rough, in consequence of the disintegration and dissolution which had taken place. A greater degree of care was necessary in operating upon plaster, than is requisite with stone, as the latter will bear a degree of heat, which will decompose the former; it will, however, resist a temperature of from 200, to 250 degrees, which is sufficient for the purpose; it cannot safely have its temperature raised, so as to approach 300 degrees.

On rendering salubrious, apartments which are damp, and consequently unhealthy.

In works which are costly, the value of the wax, used in the foregoing process, is not worth consideration; but in preventing humidity in the walls of ordinary apartments, the cheapness of the material employed, is a point of importance; in this case, rosin may be substituted for the wax, taking two or three parts of it, to one of the prepared oil. This composition was used upon two rooms, the walls of which were covered with a saline efflorescence, and which were so damp, as to be useless, even in summer. The oil for the cement, was prepared as before directed, and with this, two parts of rosin were melted in a large pot, particular care being taken in the management of the fire. After the rosin was melted, the whole swelled up considerably, but eventually subsided: it was then removed from the fire, and suffered to cool, and afterwards was re-melted, as it was wanted for use.

A large furnace was used, together with such apparatus as was found necessary for removing it from one part of the wall, to another, so as first to dry, and afterwards to heat it, to the necessary degree.

From five to six coats were found requisite, before the plastering and wall, were completely saturated: when completed, the wall had a glossy appearance, and at length became quite hard.

Preparation of Ceilings intended to be painted.

It is believed that plastered ceilings may be rendered so impervious to moisture, that they will, not only resist the action of the humidity of the atmosphere, but also of that portion of moisture which frequently percolates through them, from rooms above. The cement may be made to penetrate entirely through the plastering, rendering it nearly as impervious as prepared stone. Colours on plaster, will in this case, be as durable as when used on canvass, whilst upon ordinary ceilings, they are destroyed in the course of a few years.

Plaster Statues, and bas-reliefs made to imitate bronze, and rendered unalterable by the action of the air.

The composition of wax and oil, may be united with the soap of copper and of iron, and will produce a green, unalterable by time, and perfectly similar to that of antique bronze. With this, the finest figures may be saturated, without injury to the most delicate touches of the graver, as the whole of the mixture is absorbed, leaving no sensible covering on the surface. By this process, we may procure statues, and other ornaments for our monuments, and for our gardens, at a very reasonable price; giving to them the colour of bronze, preserving them for an indefinite period, and making them, in all respects, superior to those painted over with oil colours. Specimens of articles, prepared and coloured by the process about to be described, were exhibited, when the memoir was read.

Method of preparing the composition for plaster figures.

Take pure linseed oil, and convert it into mild soap *(savon neutre)* by means of caustic soda, to which add a strong solution of common salt; then urge the boiling, until the lees begin to thicken, and the soap can be obtained in small grains, swimming upon the surface of the liquid. The whole is then placed upon a strainer, and when well drained, is to be put under a press to remove as much of the lees as possible. The soap is then dissolved in distilled water, and the hot solution strained through fine linen. In another portion of distilled water, dissolve a mixture of 80 parts of sulphate of copper *(blue vitriol)* and 20 of sulphate of iron, *(copperas;)* filter this solution, boil a portion of it in a copper vessel, and whilst boiling, add the solution of soap, in small quantities, until the metallic solution is entirely decomposed. When this point is attained, a fresh quantity of the solution of the sulphates, is to be added, stirring the whole occasionally, until it boils. The soap in a floculent form, will thus be formed in an excess of the sulphates; it should afterwards be washed in considerable portions of boiling, and of cold water, successively, then pressed in a cloth, to dry it as much as possible, in which state it is prepared to be used in the way to be described.

Boil one *kilogramme* (2lbs. 3oz. 3dr.) of pure linseed oil, with 250

Grammes (about 8¾ ounces) of litharge, in very fine powder; pass the product through a cloth, leave it on the stove, and it will soon become clear. This done, take of

Boiled linseed oil -	300 *Grammes*	(about 10oz. 9dr.)
Soap of copper and iron	160 do. - -	(5oz. 9dr.)
Pure white wax - - - - - -		(ib.)

This mixture must be melted, by the heat of steam, or of boiling water, in an earthen vessel; it should be kept for some time in this state, to dissipate any moisture it may contain. The plaster must be heated in a stove, to 180, or 190 degrees; from whence it must be taken, to apply the fused mixture. When the figure cools, so as no longer to absorb the composition, it must be replaced in the stove, and heated as before, when more of the composition may be applied, until the work is saturated; after this, it should stand a few moments in the stove, that no portion of the colour may remain upon the surface, to injure the finer lines of the sculpture. Withdraw it from the stove, suffer it to cool in the air, leave it under cover for some days, or until the odour of the mixture has passed off, rub it with cotton or fine linen, and the work is finished.

Small articles may be dipped into the composition, and when withdrawn, any superfluous quantity may be removed, when on holding them before a fire, or otherwise heating them, the mixture will penetrate, so as to appear on the opposite side.

The reddish appearance of some antique bronzes, may be produced by increasing the quantity of iron, in the metallic soap. The soap of iron, alone, will give the brown red, of other bronzes, and the application of gold powder, to the prominent parts, will produce the desired metallic appearance.

The colour may be varied, by first colouring the plaster of any desired tint, by means of pigments dissolved in alcohol, or in water, and afterward applying a colourless metallic soap. White marble, may be imitated by soap of zinc, bismuth, or tin.

It would be proper to pour boiled linseed oil, into the interior of statues, to preserve them from the effects of humidity, and to prevent the necessity for using a large portion of the coloured composition.

The foregoing processes were all successfully tried; and clearly prove, that the plan may be advantageously pursued, for various purposes; such as preserving lower rooms, and vaults of prisons, from humidity; to prevent the leaking of cisterns; to render vessels of plaster capable of holding water; to harden statues of plaster, or of soft stone; and in many other instances, which will readily suggest themselves, and which it is therefore unnecessary to mention.

On Rotatory Steam Engines.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Sir,—In Stuart's history of the Steam Engine, is given a description of a Steam Wheel by Masterman, which he considers the best essay yet made, towards a Rotatory Engine, and that it is on a principle, most likely to be successful. The inventor's statement, gives it

a superiority as to effect, over the best reciprocating engines; but the great diameter, required for the wheel, (28 to 30 feet) to obtain a column of water, sufficient for resistance on the low-pressure plan, would be a serious objection in many cases, and in some, an insuperable one.

This objection, has led me to consider the practicability of employing a column of quicksilver, or fusible metal, instead of water, whereby it would seem, that an engine might be formed, very powerful in proportion to its size and weight, particularly applicable to steam boats, and generally preferable, where a rotatory motion is required. The specific gravity of quicksilver, being between twelve and thirteen times that of water, it would appear, that a wheel of three or four feet diameter, charged with quicksilver, would give sufficient resistance for a low pressure engine; and a wheel of eight or nine feet internal diameter of ring, would be sufficient for high pressure, in its legitimate use, say 40 lbs. or 50 lbs. to the square inch. This, at the velocity given by Stuart, as the best, viz. 400 feet per minute, would increase the useful effect, much beyond the best reciprocating engines, in which the loss by friction, indirect application, &c. is usually allowed to be equal to half the impelling force—while in this wheel, the loss would be trivial.

I forbear giving a delineation of this machine, because you have Stuart's description at hand; and, should you think the subject sufficiently important, you will re-publish it, that the attention of the ingenious may be drawn to a principle, the most promising of any yet suggested, for a Rotatory Engine.

I would further remark, that though I perceive the use, I do not see the *necessity* for the regulating fountain, employed by Masterman, nor is it explained by Stuart.

The only objection I can apprehend to this engine, is, the waste of the quicksilver, and the corrosion of the iron. Considering it worth an experiment, I had taken measures, with a view thereto, to procure the full description of Masterman's wheel, published by the inventor, London, 1822; but presume, I am anticipated in my intention, for I have just seen a statement from a New York paper, that a wheel apparently similar, is in operation there, in which the reacting force is a column of quicksilver, and is said to work well; though the calculation made of its power, must be erroneous, for the velocity there given 30×60 is 1800 feet per minute—whereas, according to Stuart, the power would be 500 lb. $\times$ 400 feet per minute, $200{,}000 \div 33{,}000 =$ about six horse power, without any deduction for friction, &c. &c.; which, if allowed to reduce it to four horse power, would be a great result from a column, whose area can be but $500 \div 54 =$ less than 10 square inches, and would consume about one half the quantity of steam required for a reciprocating engine, of like power. It is hoped you will soon be enabled to give a full description of the steam wheel at New York. BELIDOR.

The following is the description of the Rotatory Engine, lately constructed in New York. This article appeared in the Daily Ad-

vertiser, of that city, and is that to which our correspondent, Belidor, refers.

"It is a simple wheel of cast iron, with three hollow arms, (or spokes,) and a hollow rim, capable of containing 10 gallons. The axis revolves with the wheel; but it has a hub, which is stationary, and through which the steam is admitted, and discharged. The size and weight, are to be proportioned to the power desired. The weight of the wheel is 150 lbs. The lower part of the rim is charged with a quantity of quicksilver, the use of which we shall soon explain.

"When one of the arms is turned to a horizontal position, a groove in the axis opens upon a hole in the hub, by which steam is admitted from the steam pipe through the arm. On entering the rim, it closes a valve just above the arm, and by its pressure against it, tends to move the wheel, while its downward force, presses down the quicksilver. When the arm reaches the perpendicular, it discharges the steam through the axis, in the same manner in which it received it. The second arm then reaches a horizontal position, opens a communication with the steam pipe, and becomes charged; the valve closing, and a new impulse being communicated to the wheel, and to the mercury. It will be easily understood, that as the three valves open the same way, the mercury passes freely through them, while the steam successively closes them.

"We saw this engine in operation, and, as far as we could judge, it seemed to possess great advantages, over all we had ever met with. We understand that it has met the approbation of several practical engineers, and is regarded as a successful attempt at the direct application of steam. Experiments have been made in England to attain this object; but were abandoned on account of certain obstacles, which now appear to be surmounted.

"A full load of quicksilver is from 500 to 600 lbs. and forms a moveable resistance or piston, while the friction is so small, that it cannot be perceived in moving it by hand.

"It is well known, by the use of the ordinary steam guages, that it requires one pound pressure of steam, for every inch which this column of mercury is raised out of level. The column of mercury in the rim of this wheel, is 108 inches in depth, and consequently will resist a pressure of steam to 54 lbs. the square inch;* so that it will be perceived this engine is capable of creating any power required, by increasing or diminishing the pressure of steam, from 1 to 54 lbs. pressure the square inch; and if permitted to revolve 60 times to the minute, with 50 lbs. pressure of steam, it will produce, as may be easily calculated, 40 horse power. Say, 500 lbs. 30 feet high, 60 times the minute, to be 45 horse power, according to the English calculation, of 20,000 lbs. one foot high in each minute a horse power. If it is desired to carry the steam at extreme high pressure, the diameter of the wheel must be increased, two inches for each pound pressure.

"The Boiler, in which the anthracite coal is used to great advan-

* There is here some typographical error, or palpable miscalculation.—[*Ed.*

tage, to make steam for this engine, is 4 feet in diameter, and 7 feet high, with a hemispheral top; it stands upright, and consumes from 4 to 500 lbs. of coal in twelve hours, and was invented by the same persons."

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The above description is certainly inaccurate, as respects the calculations made; it appears to have been written for the purpose of giving some general idea of the construction of the wheel, by some one not scientifically acquainted with the subject. We do not think it necessary at present, to notice this point more particularly, as the main question is, whether an actual improvement has been made in the steam engine. We have seen the machine in question, but not under circumstances which would enable us to judge fairly of its merits, as it was not in operation; and, if it had been, we could only have seen that it actually went round; there not being attached to it, any thing by which its effective force might have been ascertained. The inventor did not pretend, that there was any novelty in the principle upon which it acted, but, that he had so constructed and improved the valves, that they were closed by the elasticity of the steam, and readily admitted the mercury to pass through them.* We think more favourably of this, than of most of the other plans, upon which rotatory engines have been constructed; and shall sincerely rejoice, should it ultimately prove to be, in all respects, better than the reciprocating engine; of this however, we have very strong doubts.

Numerous have been the plans proposed, and essayed, both in England, and in this country, for obtaining a direct revolving motion, from the action of steam; but hitherto, all such attempts have proved abortive, for although many of these engines have been constructed, they have been found, upon trial, to be less powerful, with the same expenditure of fuel, than a well constructed reciprocating engine, and more liable to get out of order. For ourselves, we confess, that our expectations of seeing the reciprocating, superseded by the rotatory engine, are by no means sanguine. We think, that projectors are generally mistaken, respecting the loss of power, which they think, takes place in the crank, and in reversing of the motion given to the piston, and its appendages. In this opinion, we are not singular, but have the support of many practical engineers. We shall be glad to see this subject discussed, by competent persons; it is one of great interest, and is by no means well understood. We are acquainted with those who are more capable of entering upon the investigation than ourselves, and earnestly invite them to illustrate the subject.

The boiler mentioned, as the invention of the same persons, we think, liable to several objections; but, as this forms no essential part of the plan, the discussion of its merits, is, at present, deemed unimportant.

It is probable, that we shall hereafter comply with the suggestion of Belidor, and re-publish the account of Masterman's engine.—[*Editor.*

* Col. Stevens, of Hobocken, we believe, made a similar engine, but the oxydation of the mercury, and other difficulties, caused him to abandon it.

ON JAPANNING AND VARNISHING.—No. 5.

BY THE EDITOR.

White, or light coloured Spirit Varnishes.

We have formerly remarked, that although the varnishes made from lac, are, in some respects, preferable to any of those made from the more colourless resins, yet, they cannot be applied, where a tinge of brown would be inadmissible. Pictures, maps, the lighter coloured woods, inlayed work, japanned chairs, and other furniture, with ornamental painting or gilding, if finished with varnish, require such as is nearly colourless.

The resins principally employed, are mastic, sandarac, elemi, and animi. The two former, can always be procured; the two latter, are but little used, and therefore, only occasionally found in this country. Neither mastic or sandarac alone, makes a good varnish; sandarac is deficient in gloss; mastic in hardness, and solidity; they therefore are best, employed together; the following proportions will answer well, this is sometimes called,

Hard white Varnish.

Take Gum sandarac	9	ounces
Gum mastic	3	"
Alcohol	32	"

Tingrey, in his 'Varnisher's Guide,' advises, in making varnishes of this description, to pulverise the resins, and, to add about one third of their weight of pounded glass, when they are mixed with the alcohol; this prevents the particles of resin from agglutinating, and also, from adhering to the bottom of the vessel, which is apt to take place, if the ingredients are not shaken, or stirred very frequently; when this agglutination occurs, the dissolution becomes extremely difficult. Tingrey, also advises promoting the dissolution by means of a sand, or water bath. We have repeatedly made the sandarac and mastic varnish, and have always used the resins in the lump, breaking those pieces only, which are unusually large. We have never employed any higher degree of heat, than that of the sun, or a tolerably warm room, nor have we used the pounded glass; the only precaution found necessary, has been frequent shaking, and stirring with a stick; in this way, from 12 to 24 hours, will be sufficient to complete the process; and that, without either risk, or waste. In making varnish with alcohol, much of the spirit must evaporate, if heat be employed, as the vessel would burst, if not ventilated.

We shall hereafter describe the methods which have been adopted, to effect the solution of copal, in alcohol, which in the ordinary mode of procedure, has but little action upon it. The following recipe, we have not tried, and, if we had met with it in any common book, should unhesitatingly have condemned it. Tingrey, from whom it is taken, is very good authority, as he was not in the habit of trusting to others, but, was a careful and accurate experimentor. Every chemist knows, that articles which are insoluble in a particular fluid, when alone, are sometimes rendered soluble by the presence of others, and this is probably an example of that kind.

Varnish of Copal, Sandarac, and Mastic.

Take pounded copal, of an amber colour, and which has been once liquified, according to a method to be hereafter described, 3 ounces

Sandarac	6	"
Mastic	3	"
Clear turpentine	2½	"
Pounded white glass	4	"
Alcohol	32	"

All the solid ingredients, should be reduced to fine powder, excepting the glass, from which the finer particles should be separated by a sieve, and rejected; put the whole, the turpentine excepted, into a tin bottle, or matrass; which should then be placed in a vessel, containing water, a little warm; this must afterwards be heated to ebullition, and so maintained for an hour or two; a stick of white wood, must be used to stir the mixture, which must be done very frequently, as the heat will otherwise cause the resins to unite in a mass. When the solution appears to be nearly complete, add the turpentine, which must be melted, by immersing the vessel containing it, in boiling water. The heat must be continued for half an hour longer, when the varnish may be suffered to cool; during which process, it must be constantly stirred.

Tingrey remarks, that the opinion generally entertained of the insolubility of copal, in spirit of wine, would have inspired him with some doubt, as regards its usefulness in this varnish, had he not experienced, that a much more durable varnish was produced, than could be obtained without the copal. It is probable, that the whole of this resin will not be dissolved, and that a smaller portion than that indicated, would answer every useful purpose.

A larger portion of copal may be dissolved, if ½ of an ounce of camphor be added to the ingredients; this quantity must not be exceeded. as it in some degree softens the varnish. We shall have occasion hereafter to speak more particularly of the employment of camphor, in facilitating the solution of copal in alcohol.

In digesting the ingredients, when making this, and similar varnishes, a glass matrass is usually recommended, and, it is on some accounts to be preferred, more particularly as its transparency admits of the progress of the dissolution, being readily observed. The experienced manipulator, may employ a vessel of this kind; but, in ordinary cases, the risk is great, and tin should be used. These varnishes may be filtered through cotton, or allowed to remain at rest, until the impurities subside, when they may be carefully decanted. We always prefer the latter mode.

On cleaning and Polishing brass, and preparing it for lackering.

By the Editor.

In our last number, we described the mode of preparing, and using lacker, for brass; the beauty of the work depends, however, as much upon its being properly prepared, as upon its being well lackered;

the mode of doing this, both upon old, and new work, shall now be described.

To remove the lacker from old work.

Resinous substances are soluble in potash; and as the lacker upon brass, is resinous, it may readily be removed, by means of ley, made from wood ashes. A portion of ashes and water may be put into a small iron pot, which must be made to boil; on dipping the work into the liquid, the lacker will be immediately removed, and if the surface of the brass be not corroded, it will require but little labour to prepare it for re-lackering. It ought not to remain longer in the ley, than is necessary to remove the lacker, otherwise the brass will become tarnished, and require considerable labour to polish it. When the articles are too large to dip into the ley, the lacker may be washed off, by means of a rag fastened on a stick. The strength of the ley will be greatly increased by putting some quick-lime into it.

After the removal of the lacker, the operations to be performed, will depend upon the nature of the work, and the degree in which the surface has been scratched, or corroded. The directions to be given for new work, will apply equally well, to old. Wrought work, that is, such as is not finished with the file, or turned, but consists of foliage and other ornaments, will, if much soiled, require to be annealed, that is, heated to redness in the fire, and otherwise managed as new work.

On Finishing, Burnishing, or Polishing, brass work.

Articles which are filed up, or turned, are in general either polished, or burnished, preparatory to their being lackered. Work which is well turned, requires but little polishing. For preparing, and polishing brass, different articles are recommended, and employed, by different workmen; we have found that fine glass paper covered with sweet oil, will give a perfectly smooth surface; which may then be polished with oil and rotten stone, upon a woolen rag, and cleaned off with fine dry whiting, upon a piece of cotton or linen. The use of glass-paper and oil, was adopted by us many years since, and we believe, was then new: it is adapted both to coarse and fine work, and has the advantage of producing the desired effect, with greater rapidity than any other method, with which we are acquainted. Glass-paper, is frequently called sand-paper, and is often sold under that name; sand-paper was formerly much used, but is now almost unknown, the glass-paper being much superior to it, for all purposes. Emery-paper is sometimes used; for iron, it is a very good article, but for brass, is not better than glass-paper, which is much cheaper; if not sufficiently fine, the glass paper may be made so, by rubbing it with the pane of a hammer.

Work which is filed, may also be finished in the way above described. For flat work, the glass-paper is wrapped round a suitable piece of wood, and after being oiled, is used in the manner of a file. It may then be polished with oil and rotten stone, upon a woolen or leather buff. The finest kind of work, after being smooth-filed, is

rubbed with a piece of wet pumice stone, afterwards with blue stone, and then with charcoal; this leaves it with a perfectly fine surface, well prepared to receive a polish from oil and rotten stone, with but little labour. There are several species of stone, in different parts of the Union, which may be substituted, both for the pumice stone, and the blue stone. Instead of the latter, the Scotch stone, called, *water of ayr*, is often used: this exists in abundance, in the State of North Carolina. The best charcoal, is that made from willow, but good pieces may generally be picked out from a heap; they, however, can be judged of, by trial only. The rubbing with charcoal, is a slow business, and may, in general, be dispensed with.

When a bright polish is not desired, but the work is to appear with a fine surface, the *grain* may be laid with the glass-paper, and oil; with oil and fine powdered pumice stone, or with the finest washed emery and oil, upon a buff.

Burnishing on brass, is performed only on inferior kinds of work, or upon such parts as do not admit of being polished. A burnished surface is the most brilliant, but has much less *truth* than one which is well polished. For brass, steel burnishers are always used. The general directions in the article on burnishing, extracted from the *Dictionnaire Technologique*, and published in our present number, may be referred to, upon this subject. In burnishing small articles, the burnisher may be moistened by touching it with the tongue: weak beer is frequently used for larger work, instead of the soap-suds, used with silver, as mentioned in the paper just referred to. After burnishing, the articles are washed clean, and wiped perfectly dry, when they are fit for lackering.

On finishing wrought work.

Wrought work, after having the parts which are intended to be burnished, either scraped or filed, is to be annealed in a charcoal fire; a pickle is then made, by pouring aqua fortis *(nitrous acid,)* into water, until it is intensely sour; into this pickle, the articles are put, and suffered to remain, until all the black scale is removed, and the whole surface exhibits one clear, uniform, red; they are then to be taken out, washed and dried, when they are ready for *dipping*, or *taking off*. Some clear aqua fortis is poured into a cup, and the article, if small, is dipped into it, and immediately removed; otherwise it is washed over, by means of a piece of rag, tied on to the end of a stick; the acid immediately boils up, when it must be washed off, by being passed successively, into two or three vessels containing water, as the smallest remaining portion of acid, will cause the surface to tarnish. A little practice will enable the operator to judge of the instant when the acid should be washed off, by the colour which it assumes. The surface will now exhibit a clear and beautiful gold yellow, provided the brass, and the acid, are both of a proper quality. The parts which are to be burnished undergo that operation, either by hand, or in the lathe, according to the nature of the articles. The usual mode is to put them into small beer, from which the pieces are successively taken and burnished, when they are thrown into clean water,

and dried in the saw-dust of some wood which is not resinous. Sometimes the work is scratch-brushed, before burnishing; this however, removes that beautiful dead appearance, which is in general preferred, and leaves a general brightness, upon the unburnished parts.

The scratch-brush is made of small brass wire, formed into bunches, which for large work, are fixed around a chuck, and made to revolve in the lathe; beer is used in this operation, as in burnishing.

FOR THE FRANKLIN JOURNAL.

Observations on the Hydraulic Cement, used on the Pennsylvania Union Canal.

Every one, who from curiosity or interest, has visited the Union Canal, which is intended to form a junction of the Susquehanna, with the Schuylkill, has seen with the highest satisfaction, the solid and beautiful masonry, with which the locks on the Canal are constructed. Many of these works have been completed upwards of a year, and their foundations have been covered during that time, with water. They exhibit the most solid and unimpaired appearance, alike uninjured, by remaining either wet or dry, and by cold or heat.

The stone work of these works, has been laid in water lime, invented by Mr. Guilford, the cost of which, is less than one third of that of Roman cement, for which it is a complete substitute.

Mr. Guilford, is one of the most distinguished engineers of the Union Canal, and he has, on request, furnished the following account of this most valuable material, and of the mode of using it—he has obtained a patent for the discovery of the water lime. His address now is, Lebanon, Pennsylvania, or the Union Canal office, Philadelphia. P.

A description of the Mineral, from which the Pennsylvania Cement is manufactured.

This mineral occurs in masses, associated with compact limestone, and argillaceous slate—its structure, though usually slaty, is sometimes stratified—sometimes also, its masses are composed of columnar distinct concretions—its cross fracture is uneven, and its longitudinal fracture, even and dull, or foliated, with a lustre, more or less shining and vitreous. Its colour is black, or bluish-black; it effervesces with acids; and when calcined, its colour is yellowish, or reddish-brown. A specimen, analyzed by Dr. Seybert, yielded

Carbonic acid and water	23.66
Lime	20.66
Silex	32.
Alumine	12.66
Magnesia	1.71
Oxide of iron	5.66
	96.35
Loss	3.65
	100.00

The manner of preparing the Cement, is as follows.

The stone is calcined in kilns, then ground to a powder, and mixed with clean sand, in various proportions, usually by equal measure. The cement should be ground, soon after it is calcined, and kept so that no wet, or damp, be suffered to come in contact with it; nor should it be much exposed to the air before it is used. The cement and sand, should be mixed together dry, and then, as little water added as may be necessary to form the mortar into a uniform paste, when it is well beaten. If the cement be mixed with sand, by equal measure, it will require about 3½ bushels, to construct a cubic yard of masonry.

S. GUILFORD.

Note by the Editor.—Our correspondent P. informs us, that a patent has been taken out by Mr. Guilford, for the Hydraulic Lime. We are at a loss to know, for what discovery, or improvement, in the nature of the materials, or in the mode of using them, the exclusive right is claimed; so far as appears in the papers before us, there is not any thing new in either; and, excepting there is something special, which is at present out of sight, we cannot perceive how a claim to an exclusive privilege, could, in the present instance, be sustained, any more than it could for common mortar, made from a newly discovered bed of lime-stone. We do not pretend to much knowledge in the law, but apprehend, that the "discovery," contemplated in the patent law, is not the discovery of minerals, deposited by the hand of nature, under the surface of the earth. These remarks, are made with deference, as the respectability and intelligence of the persons concerned, are such, as to induce us to suppose, that we may have fallen into the common error, of judging, without a sufficient knowledge of all the premises.

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*On Burnishing.**

To burnish an article, is to polish it, by removing the small eminences or roughnesses, upon its surface; and the instrument by which it is performed, is denominated a BURNISHER. This mode of polishing, is the most expeditious, and gives the greatest lustre to a polished body. It is made use of by gold and silversmiths, cutlers, locksmiths, and most of the workmen in gold, silver, copper, iron, or steel. It removes the marks left by the emery, putty of tin, or other polishing materials; and gives to the burnished articles, a black lustre, resembling that of looking-glass. The burnisher is an instrument, the form and construction of which, is extremely variable, according to the respective trades; and, it must be even adapted to the various kinds of work, in the same art. We shall point out the principal ones. In general, as this tool is only intended to efface inequalities, whatever substance the burnisher is made of, is of little consequence to the article burnished, provided only, that it be of a harder substance than that article.

* From the *Dictionnaire Technologique*.

We shall first describe the art of burnishing silver articles, and afterwards point out the variety of modes in which the burnisher is used, in other arts.

When silver articles have received their last fashion from the silversmith's hands, that is to say, when they have been worked, soldered, repaired, or adjusted, they are sent to the burnisher, who has the care of finishing them. He must begin, by cleaning off any kind of dirt which their surfaces had contracted whilst making, as that would entirely spoil the perfection of the burnishing. For this purpose, the workman takes pumice-stone powder, and, with a brush, made very wet in strong soap-suds, he rubs, rather hard, the various parts of his work, even those parts which are to remain dull; and which, nevertheless, receive a beautiful white appearance. He then wipes it with an old linen cloth, and proceeds to the burnishing.

The burnishers used for this purpose, are of two kinds; some of steel, others, of hard stone. Steel burnishers are either curved or straight; rounded or pointed; and made so as to suit the projecting parts, or the hollows of the piece.

Stone burnishers are made of blood-stone (*hæmatite*) cut, and either rounded with the grindstone, or rubbed, so that they present at the bottom, a very blunt edge, or sometimes a rounded surface. These are polished with emery, like steel burnishers, and are finished by being rubbed upon a leather, covered with *crocus martis*. The stone is mounted in a wooden handle, and firmly fixed by means of a copper ferrule, which encircles both the stone and the wood. The best blood-stones, are those which contain the most iron, and which, when polished, present a steel colour.

The operation of burnishing, is very simple: it is only requisite to take hold of the tool very near to the ferrule or the stone, and lean very hard with it, on those parts which are to be burnished, causing it to glide by a backward and forward movement, without taking it off the piece. When it is requisite that the hand should pass over a large surface at once, without losing its point of support on the work-bench, the workman, in taking hold of the burnisher, must be careful to place it just underneath his little finger. By this means, the work is done quicker, and the tool is more solidly fixed in the hand.

During the whole process, the tool must be continually moistened with black soap-suds. The water with which it is frequently wetted, causes it to glide more easily over the work, prevents it from heating, and facilitates its action. The black soap, containing more alkali than the common soap, acts with greater strength in cleansing off any greasiness, which might still remain on the surface; it also more readily detaches the spots, which would spoil the beauty of the burnishing.

In consequence of the friction, the burnisher soon loses its bite, and slips over the surface of the article, as if it were oily. In order to restore its action, it must be rubbed, from time to time, on the leather. The leather is fixed on a piece of hard wood, with shallow furrows along it. There are generally two *leathers*—one made of sole-leather, and the other of buff-leather. The first, is impregnated with a little

oil and *crocus martis*, and is particularly used for the blood-stone burnishers; the other, has only a little putty of tin, scattered in the furrows, and is intended exclusively, for rubbing steel burnishers, as they are not so hard as the blood-stones.

Blood-stone being very hard, the workman uses it whenever he can, in preference to the steel burnisher. It is therefore only in small articles, and in difficult places, that the steel burnishers are used; as they, by their variety of form, are adapted to all kinds of work. But in general, the blood-stone greatly reduces the labour.

When the articles, on account of their minuteness, or from any other cause, cannot be conveniently held in the hand, they are fixed in a convenient frame on the bench: but under all circumstances, the workman must be very careful to manage the burnisher, so as to leave untouched, those parts of the work, which are intended to remain dull. When, in burnishing any article, which is plated or lined with silver, he perceives any place, where the layer of precious metal is removed, he restores it, by silvering these places, with a composition supplied by the silverer, which he applies with a brush, rubbing the part well, and wiping it afterwards, with an old linen cloth.

The burnishing being finished, it only remains to remove the soap-suds, which still adheres to the surface of the work: this is effected, by rubbing it with a piece of old linen cloth, which preserves to it all its polish, and gives so great a lustre, that the eye can scarcely bear to look upon it. But, when the workman has a great number of small pieces to finish, he prefers throwing them into soap-suds, and drying them afterwards with saw-dust, which is more expeditious.

The burnishers of articles which are not silver, follow nearly the same process, as that above described. We shall briefly notice the variations to be observed in each case.

The burnishing of leaf-gold or silver, on wood, is performed with burnishers made of wolves' or dogs' teeth, or agates, mounted in iron, or wooden handles. When they burnish gold, applied on other metals, they dip the blood-stone burnisher, into vinegar; this kind being exclusively used for that purpose. But when they burnish leaf-gold, on prepared surfaces of wood, they are very careful to keep the stone, or tooth, perfectly dry. The burnisher used by leather-gilders, is a hard polished stone, mounted in a wooden handle; this is used to sleek, or smooth the leather.

The ordinary engraver's burnisher, is a blade of steel, made thin at one end, to fit into a small handle, which serves to hold it by. The part in the middle of the blade, is rounded on the convex side, and is also a little curved. The rounded part, must be well polished, and the tool be very hard.

They use this burnisher to give the last polish to copper-plates, rubbing them well with it, and being very careful to use oil continually, to lubricate it. Other burnishers, are nearly of the same form as those used by the gilders and silverers.

In clock-making, they burnish those pieces or parts, which, on account of their size or form, cannot be conveniently polished. The burnishers are of various forms and sizes; they are all made of cast-

steel, very hard, and well polished: some, are formed like the sage-leaf files; others, like common files: the first, are used to burnish screws, and pieces of brass; the others, are used for flat-pieces. The clock-makers have also very small ones of this kind, to burnish their pivots; they are called *pivot-burnishers.*

The burnishing of pewter articles, is done after the work has been turned, or finished off with a scraper: the burnishers are of different kinds, for burnishing articles either by hand, or in the lathe; they are all of steel, and while in use, are rubbed with putty powder on leather, and moistened with soap-suds.

The burnishing of cutlery, is executed by means of hand, or vice burnishers; they are all made of fine steel, hardened, and well polished. The first kind, have nothing particular in their construction; but the vice burnishers, are formed and mounted in a very different manner. On a long piece of wood, placed horizontally in the vice, is fixed another piece, as long, but bent in the form of a bow, the concavity of which, is turned downwards. These two pieces, are united at one of their extremities by a pin and a hook, which allows the upper piece to move freely around this point, as a centre. The burnisher is fixed in the middle of this bent piece, and it is made more or less projecting, by the greater or lesser length which is given to its base. The moveable piece of wood, at the extremity opposite to the hook, is furnished with a handle, which serves the workman as a lever. This position, allows the burnisher to rest with greater force against the article to be burnished, which is placed on the fixed piece of wood. They give to the burnisher, either the form of the face of a round-headed hammer, well polished, to burnish those pieces which are plain or convex; or the form of two cones, opposed at their summits, with their bases rounded, to burnish those pieces which are concave or ring-shaped.

The burnishing of the edges of books, is performed with a wolf's or dog's tooth, or a steel burnisher: for this purpose, they place the books in a screw press, with boards on each side of them, and other boards distributed between each volume; they first rub the edges well with the tooth, to give them a lustre. After sprinkling or staining, and when the edges are become dry, they first burnish the front; then turning the press, they burnish the edges at the top and bottom of the volume.

They burnish the gilt edges in the same manner, after having applied the gold; but observe, in gilding, to lay the gold first upon the front, and allow it to dry; and, on no account, to commence burnishing till it is quite dry.

FOR THE FRANKLIN JOURNAL.

Remarks upon the Use of Anthracite, and its Application to the various purposes of domestic economy.

The use of the anthracite, as a fuel, has been so generally approved, that it seems likely to supersede, to a great degree, all other substances both in manufactories and families. In almost every case, where it has been tried for parlour use, it may be said to have gained the preference over, even the best hickory wood; and it is not unlikely that at no distant day, it will obtain an equally firm footing in our kitchens. Notwithstanding however, the number and variety of trials that have been made, it does not appear that any particular form of grate, or size of flue, has as yet obtained a general, or decided preference: in fact, it is rather remarkable, that some of the first attempts should be adhered to, when their inconveniences are but too obvious. This is probably attributable to the want of a collection of facts, ascertained with correctness, which might serve to settle the general principles applicable to the subject. To assist in forming such a collection, the following remarks are put upon paper, by an individual who has given much attention to the use of the anthracite, during the last four years. It is quite probable, that similar observations may have been made by others, but as the results were new to himself, and to almost all with whom he has conversed, he is inclined to believe that, if known, they have not received the attention to which they are entitled.

The first experiments were made on the fourth, fifth, and sixth, of the fourth month, (April,) 1826, and were intended to determine, whether a great draught, and a small flue, are indispensable, in order to burn the coal with ease, and to produce the quantity of heat required for ordinary purposes, and were made in the following manner.

A common cast iron Liverpool coal grate, was placed in a large open wash-house chimney, and being merely supported upright, by means of dry bricks, the flue was left of its ordinary size as when used with a large wood fire. The fire chamber of the grate, was entirely of iron and not lined with brick, or any other substance. A fire was first kindled with Swatara coal, as being the easiest to ignite, and was continued throughout a day. On the following day, a fire was made of Schuylkill coal, and on the third day, of the Lehigh. In each case, the fire was as good, as those made of the same kinds of coal, in other grates, and required about the same attention to keep up the combustion; the Swatara coal, requiring the smallest quantity of charcoal to kindle it, and the Lehigh, the largest; whilst a much greater proportion of the former, was bright and glowing, than of the latter. The Schuylkill coal, appeared to be at a medium between the two, in these respects.

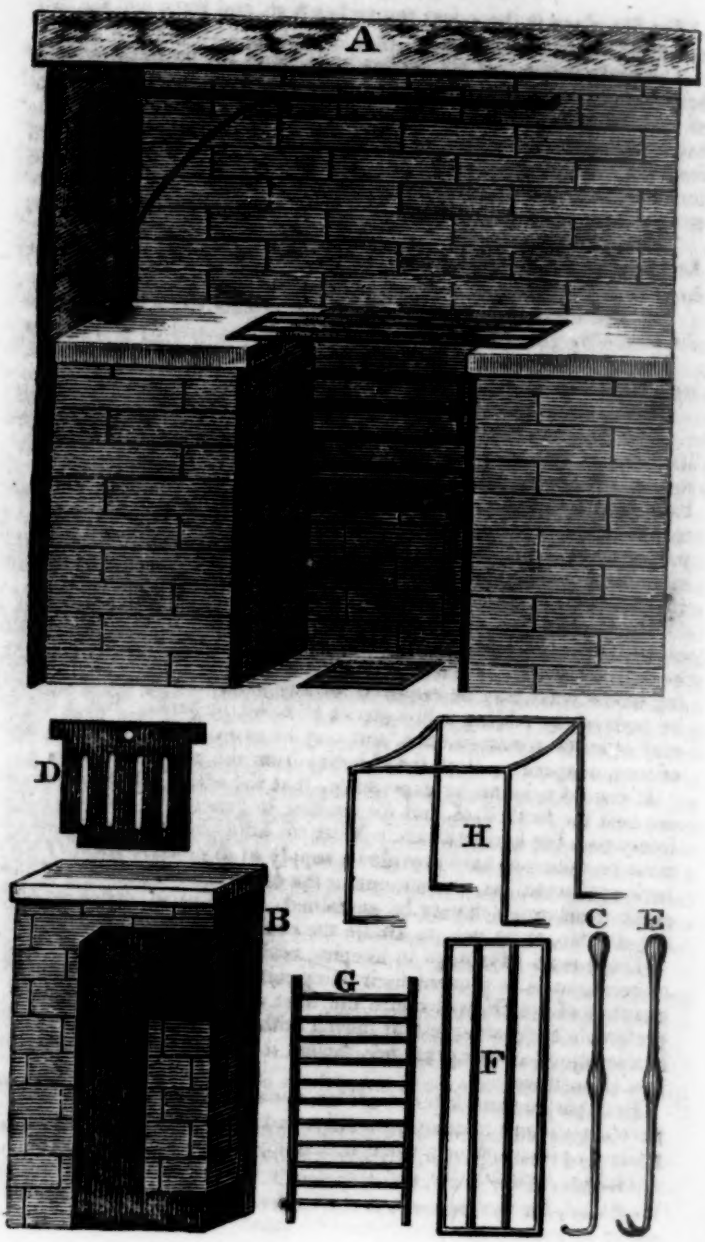
Another trial was made by placing several iron bars upon the andirons, in an open Franklin stove, upon which the coal was burned with perfect ease, making a beautiful fire, and casting out a heat quite equal to that from wood.

From these results, it seems that a small flue, and a great draught, are not indispensable, for the purpose of making a good fire of anthracite. The latter, it is true, is of some importance in kindling the fire, but if a blower be used, the draught will be greater, and the fire be more quickly kindled, with a wide flue, than with a narrow one. The common objections to a fire of anthracite, now that the difficulty of kindling is surmounted, are, that it throws more dust into the room than wood does, and imparts an unpleasant dryness to the air. These objections are certainly in many cases well founded, and their removal is of importance to persons of delicate constitutions, and to those who are studious of neatness in their parlour arrangements. That they generally, if not always, proceed from having the flue too much contracted, and the grate too much projected into the room, there can be no doubt. By an increase in the size of the flue, and by placing the grate more backward in the chimney, the objections here referred to, may be entirely obviated; but, in that case, it may be needful to increase the size of the grate, so as to produce an increased quantity of heat, as a portion of it must necessarily escape, by an enlargement of the flue. A parlour grate, erected in conformity to these views, is found to answer perfectly well.

The next experiment, was made in order to determine whether the common culinary operations of a family, could be carried on as conveniently with coals, as with wood. For this purpose the first mentioned grate was removed, and placed in a common kitchen chimney, with a wide flue, and open front; and all the usual processes of family cooking, &c. were tried, and found to answer in the most satisfactory manner. The use of this grate was continued for some weeks, until the plan of another was fully decided upon, embracing alterations calculated to obviate some small inconveniences. This grate having been permanently erected in place of the former, it has been used daily, with the anthracite coal, during the last four months, for all the kitchen purposes of a small family, (except baking of bread, which has not been tried,) and has proved as complete in all respects, as the common wood fire. In some points it is in fact preferable, as it does not require the cook to stoop, as at a wood fire, and the fuel is supplied with much less labour; and the steam and other exhalations being carried off by the open flue, the comforts of the kitchen, are in no way diminished, but, on the contrary, increased, by an entire exemption from the too common annoyance of smoke.

The following is a plan, and description, of the kitchen grate, thus put into use.

A. Front view of the chimney-place, grate, crane, &c.
B. The side flue, to assist the draught.
C. Poker, about three feet in length.
D. A cast iron plate, used to partition off a part of the grate, so as to make a small fire.
E. Hook, for lifting and drawing out the moveable bottom of the grate.
F. Guard iron to be placed above the fire for pots, &c. to stand upon.
G. Bottom of the grate, made moveable.
H. Stand, for the tin roaster.


A
D
H
B
C
E
G
F

The fire-place is three feet ten inches high, and three feet ten inches wide.

The grate is one foot six inches wide, nine inches deep, and the bottom, fourteen inches above the hearth; the bars are three quarters of an inch in thickness, and the space between them, an inch and a half: the bottom bars, are half an inch thick, and an inch apart. The front bars, are of square iron, and the upper one is moveable, and falls forward, so as to be on a level with the second, forming a convenient situation for a toaster, or other article, to be placed before the fire.

The side platforms, are two feet one inch high, containing the side flues, which are two and a half inches, by four inches, covered at top by a soap stone slab.

The main flue is five inches and a half wide, and runs all across the chimney.

The guard iron, is one foot ten inches long, and nine inches wide, with bars, half an inch square, and two inches asunder.

The dividing iron D, corresponds with the dimensions of the grate.

This grate* is of a size suited to a small family, but by extending its dimensions, accommodation may be had for the largest establishments. A second crane may be added, and the depth towards the back of the chimney, increased, without injury to the other arrangements. The usual operations of boiling, roasting, and broiling, in a proper state of the fire, may be performed with the greatest ease; and after being accustomed to the use of it, there is little doubt, but our cooks would, in general, prefer the coal fire, to the wood.

The kitchen fire, referred to, has always been kindled without a blower, merely by using dry bark, which, on experience, is found to be extremely well suited for the purpose; and in case of the fire sinking below what may be required for any particular operation, it may be revived, by adding a few pieces of wood or bark. But a blower may often be a convenience, and may be made with a common sheet of iron, adapted to close the chimney from the grate, upwards.

It has been found by experience, that the softer kinds of coal, are the best for small fires, and for cooking in general, as they burn more freely than the harder kinds. With all kinds however, especial care must be taken, to have provided a supply of dry oak, or hickory wood, bark or charcoal, as, without one or the other of these, always at hand, great inconvenience may be sustained. Pine-wood, cedar, or chips, are of little, or no use, to kindle the coal.

There is an advantage in keeping coals upon a flooring of boards or brick, so as to prevent their being mixed with earth, a very small quantity of which, will injure the fire: and coal, loaded by hand, is preferable for grates, to that moved with the shovel, as the fine stuff, is also injurious to a grate fire, though it may be advantageously used in a close stove.

Both parlour and kitchen grates, upon the plans above mentioned, have been found to answer so fully, that the writer of these notes, has made no provision for a wood fire, in his house. J. V.

11 Mo. 1, 1826.

* It was made by Stephen P. Morris, corner of Third and Walnut streets, and put up by Raper Smith, Arch, near Fifth street.

FRANKLIN INSTITUTE.

Committee of Inventions, Sept. 12th, 1826.

The committee of inventions, who, at the request of Mr. James Vaux, of this city, have examined his kitchen grate, and other arrangements, for the burning of anthracite coal,

Report, That the object which Mr. Vaux had in view, in the experiments which he has made, was to ascertain, whether anthracite might not be burnt in an ordinary, open fire place, and applied to all the purposes of domestic economy, for which wood, or bituminous coal, is generally used. As it is the intention of Mr. Vaux to describe his apparatus, and to communicate his observations to the public, the committee deem it unnecessary for them to enter at large on the subject, and they will therefore, merely state, that, in their presence, fires were readily kindled, without using a blower, both in a grate constructed for cooking, and other purposes, and standing in an open fire place in the kitchen; and also, in a common, cast iron, English grate, placed in a parlour fire place, without altering the existing size or form, of the opening or throat of the chimney; and that it appeared evident to them, that all the purposes proposed by Mr. Vaux, were perfectly attained. It was not pretended by the experimentor, that he had made any discovery, which could be denominated new, but, only that he had succeeded in proving erroneous, an opinion, which is still generally prevalent, viz. that anthracite, cannot be used for cooking, excepting in a stove; a grate, forbidding its convenient use, in consequence of the supposed necessity for bringing forward the back, and closing the throat of the chimney.

The committee believe, that Mr. Vaux has perfectly succeeded in proving the incorrectness of this opinion.

By order,

THOS. P. JONES, *Secretary.*

Proposed Geological Survey of the State of Pennsylvania.

A public address, intended to promote a Geological and Mineralogical survey of this state, was delivered in the Hall of the Franklin Institute, on the 30th of September, by Peter A. Browne, Esq.

The meeting was very respectably attended, and when the address was concluded, Dr. R. M. Patterson, was called to the chair, and Gerard Ralston, Esq. appointed secretary. Resolutions were then passed, approbating the proposition, and complimenting the gentleman, who had delivered the address. A committee was appointed, consisting of Peter A. Browne, C. C. Biddle, E. S. Burd, Stephen Duncan, John Wurts, Dr. R. M. Patterson, Gerard Ralston, and Henry S. Tanner. This committee, was requested to report to a future meeting, a plan for carrying the proposition into effect; for which purpose, they were authorized to call another meeting of the citizens.

The address has been published, and a short abstract of it, will undoubtedly be acceptable to our readers.

After noticing the importance of Geology and Mineralogy, in their connexion with general science, and the particular inducements and facilities, which the United States afford, for the prosecution of these studies, a plan is proposed, for the attainment of the main object of the address.

As an encouragement to the prosecution of the survey, it is stated, that the services of that eminent Geologist and Mineralogist, Mr. Lardner Vanuxem, can be procured. This gentleman, was educated at the celebrated school of Mines, in Paris, and is now a professor in the college of South Carolina. In the department of drawing and engraving the maps, Mr. Henry S. Tanner, of this city, has offered his services; his abilities in that line, are very generally known.

It is proposed, to divide the whole state, into 26 districts, each district, to embrace from one, to three counties; and to be made the subject of a separate geological map; the engraving, and publication of which, shall proceed, as the districts are successively surveyed. The whole, to be engraved on a scale, of two miles to an inch, and to contain all the geographical information now possessed, or which may be furnished by the survey. It is supposed, that the survey may be completed in five years, and that the expense will be about $5,000, per annum, and that this expense, together with the cost of executing the maps, and transporting and arranging the Mineralogical and Geological collections, which will be made, may be defrayed by the sale of the maps; provided, fifteen hundred subscribers can be obtained, at one dollar for each map.

Besides, a grand collection of the Geology and Mineralogy of the whole state, to be arranged in geographical order, it is proposed to supply a county collection, to each county that furnishes thirty subscribers.

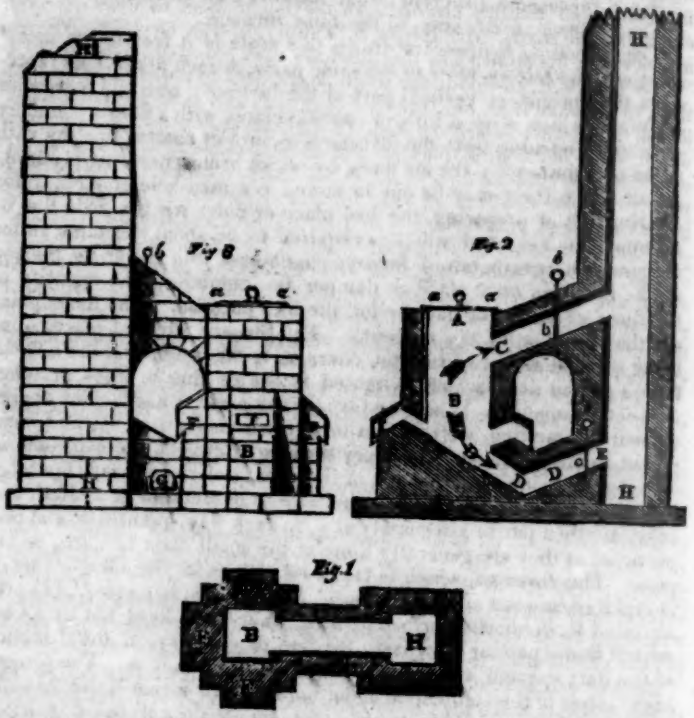
Attention is called to the importance of this survey, in aiding the exertions, now making for the internal improvement of the state; as it would point out all those facts, most important to be known. Notice is also taken of the advantages, which would accrue to the manufacturing interest, by the discoveries, which must result from such a survey, as it will bring to light those metals, earths, and combustibles, which are employed in the various arts and manufactures, and point out the places most suitable for manufactories.

Agriculture, it is said, will be greatly promoted by this survey, as it will not only make the places known, where those valuable minerals may be obtained, which serve to enrich the soil, when employed as manures; but it will also render the fact manifest, that there are extensive portions of the state, in which the land is excellent in quality, and which by their vicinity to water courses, or to mineral treasures, will offer encouragements to the cultivator of the soil, of which he is not, at present, aware.

We must now close our notice of this address; the importance of the subject is evident to all, and should not the present effort succeed, it will still be productive of benefit, by awakening public attention, and, perhaps, by pointing out to others, the road in which we ought to have travelled.

ENGLISH PATENTS.

Specification of the Patent granted to JOHN WHITE, *the younger, and* THOMAS SOWERBY, *both of Bishop-Wearmouth, in the county of Durham, Merchants, for an improved air furnace, for the purpose of melting or fusing metallic substances.* Dated November 6, 1824.



To all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, we, the said John White and Thomas Sowerby, do hereby describe and ascertain the nature of our said invention, and in what manner the same is to be performed, reference being had unto the drawings hereunto annexed, (that is to say): Our invention of an improved air furnace, for the purpose of melting or fusing metallic substances, consists in our so adapting it as to have the means of giving to the current, or currents, of air admitted by a flue or opening, or by flues or openings, in the side or sides

of the furnace, different directions through the fuel, as the heat is required to be applied; and of using coke or other fuel, with greater advantage than has hitherto been done, without the aid of a mechanical power, as used for the blast furnace or cupola. One example of our invention we shall give as follows (that is to say):—

Fig. 1 in the cut, shows a ground plan of our improved air furnace, as adapted for melting pig, or cast iron, for foundry purposes, which operation has been usually performed by means of the common reverberatory furnace, or by a small blast furnace, otherwise called a cupola.

Fig. 2 represents a section of our improved air furnace.

Fig. 3 shows an elevation of the same furnace.

The preceding figures, are drawn to a scale of 4 feet to an inch,* and the same letters, refer to the same parts, in each figure. AB represents the upright, or vertical part of the furnace: DDD the bottom or bed place, which is open into, or communciates with a flue, or chimney at E: C an opening from the furnace also, into or communicating with a flue or chimney: F the air flues, by which atmospheric air is admitted, of which there may be one or more: G a man-hole or opening for clearing out or preparing, the bed place or flue: HH the main flue or chimney, the height of which is required to be about the same as for the common reverberatory furnace; *aa* a cast iron cover for the top of the furnace: *bb* a plate or damper for regulating the capacity of the flue: *cc* a plate or damper for the like purpose. The darts point out the direction of the currents. The furnace and bed place, DDD, being cleared and prepared, the cover *aa* is taken off, and the coke or fuel is put in at A, which is lighted at the air flue or flues, or other convenient opening. When the furnace has come to a sufficient degree of heat for melting, well known to any workman used to, and competent to attend the reverberatory furnace or cupola, the man-hole or opening, G, being closed in the ordinary way of closing such openings in furnaces, by a loom cake or otherwise; the metal to be melted, and coke, are then put in alternately at A, in such way, quantities, and proportions, as they are generally done in the small blast furnace, or cupola. The cover *aa*, which is taken off to put in the coke or metal, is replaced as soon as that is done. As the metal is melted, it is precipitated to the bottom or bed at DDD, where it is kept hot by a current of flame passing over it to the flue or chimney, in the direction of the dart BE, and whence it is drawn off for use at *o*. The foregoing example of the application of our improved air furnace, will be sufficient to enable a workman to construct one, for the purpose of melting, or fusing, other metallic substances; but the furnace may be either square, or round, or oval, or octagon, or any other form, retaining the power of giving to the current or currents of air admitted by a flue or opening, or by flues or openings in the side or sides of the furnace, different directions through the fuel, as the heat is required to be applied.

In witness whereof, &c. &c. &c.

* By the scale in the engraving, from which the cuts were taken, we should have supposed the drawing to be on a scale of eight feet to an inch.—[*Editor.*

Observations by the Patentees.

In the foregoing specification it is stated that the patent air furnace is applicable to various metallurgical purposes.

To enter into all the particular cases in which it may be advantageously adopted, and to illustrate them individually, by example, would be a work more fit for a series, than for one article in a periodical journal. Therefore, as an example has been already given of it as adapted for melting cast iron, the present observations are designed more particularly to show its advantages over the means now used for *that purpose*, than necessarily come within the limits of a specification. A reverberatory air furnace, or a cupola (a small blast furnace,) is generally used for melting pig, or cast iron. That so little has heretofore been done towards bringing to perfection a more complete and economical furnace than either of them, is somewhat surprising. They are each very expensive, both as regards their original cost and their subsequent operations. They are widely different in their principles, and reciprocally possess advantages over each other, whilst neither of them is adapted for all the purposes of a foundry furnace. Such being the case, a cheap and simple furnace, which combines all that is desirable in both, and is free from all that is objectionable in either, and which performs its operations at a considerably less cost, must be considered an important and useful invention. That the patent air furnace fully answers the above description, will appear from the following comparisons of it, with the reverberatory and the cupola respectively, than which, we are persuaded, further arguments will not be required to secure its adoption in the cast iron foundry.

The Patent Air-furnace, and the Reverberatory Air furnace, compared.

Firstly,—The reverberatory is a large and expensive building. The patent furnace is a compact and cheap erection; it will generally be found not to occupy one fourth as much ground as the former, and in its construction there is a much less proportion of expensive materials; no grate-bars, and very little other iron work, being required for it; neither need the chimney be lined to the top, with fire bricks.

Secondly,—The reverberatory is supplied with air by natural means, without the aid of machinery; and so, also, is the patent furnace. But the quality of the air supplied to the fire in each is different. The air, on its way to the former, passes through the heated ash pit, and is thereby considerably rarefied. The air flues, by which atmospheric air is admitted to the patent furnace, are so constructed as to intercept in a great measure, the radiation of heat, so that the air in the outer regions of the furnace, suffers very little rarefaction, and is therefore the more fit for supporting combustion.

Thirdly,—There is a great difference in their consumption of fuel to melt a given quantity of metal. A small patent furnace, melted at one time, five tons of metal, for which it did not require one ton of coke. It would have required about five tons of good pit coal, to have melted the same quantity in a reverberatory furnace. This is owing

to the different way in which the metal is submitted to the action of heat in each (or in which the heat is applied in each.)

Fourthly,—The metal melted in the reverberatory, suffers materially in its quality. From the extended surface of melting and melted metal being exposed to the action of a passing flame, it is partially decarbonized, and is thus frequently rendered unfit for many kinds of castings. The metal in the bottom, or well, of the patent furnace, is protected by a quantity of small coke resting on its surface, so that when run into goods, it is of very superior quality to the former.

Fifthly,—The ordinary waste of metal, by the reverberatory furnace, is considerable. It may be averaged at 10 per cent. of the whole weight put into the furnace. The waste by the patent furnace does not exceed that by the cupola, which will rarely be so much as 5 per cent. This difference is principally attributable to the same cause as the difference in quality produced by the two furnaces.

Sixthly,—The patent furnace melts more metal in a given time than the reverberatory. The furnace from which the drawings are made has melted from 16 to 18. cwt. in one hour.

Seventhly,—In using the reverberatory furnace, unless the furnaceman be unremitting in his attention to the fire, &c. much damage may be sustained by the metal being converted into what is sometimes termed scull iron, or into a useless malleable state. On the contrary, if the patent furnace be but regularly supplied with fuel as the ignited mass descends, as in the case of the cupola, its operations will be uniform.

Eighthly,—The reverberatory furnace is very expensive to keep in repair. The interior of the furnace and chimney are liable to considerable wear by the action of the flame. The flame of the coke used in the patent furnace extends but a short way, and is not so destructive in its quality. Besides which, there is a much less surface exposed to the injurious effects of the fire, and no iron grate-bars, to renew.

Ninthly,—The smoke, and dense flame, frequently issuing far above the top of the reverberatory chimney, is truly terrific, as well as being very injurious, when situated in the middle of a town. Nor is it less dangerous and objectionable when on the sea coast. There is no such flame, or smoke, seen rising above the top of the chimney of the patent furnace.

The Patent Air-furnace, and Cupola, compared.

Firstly,—The cupola is supplied with air by mechanical means. It is consequently quite useless without its appropriate blowing machinery. The patent furnace although it resembles the cupola both in its mode of action and results, is nevertheless, *complete in itself*, requiring no blowing machinery, by reason of which its original cost is much less.

Secondly,—The cupola not only requires the appendages of blowing machinery, but there is also a mechanical power required to work it; sometimes steam-engine, or horse, or water power, is used. Hence,

besides an additional expense for the steam-engine, horse, or water power, and intermediate machinery, &c. there is an immense and continual charge intailed upon its operations, for the production of the mechanical power. Nor is this less when manual labour is applied, which is sometimes done in small foundries. The patent furnace *requires neither steam-engine, water, nor animal power*, nor any machinery.

Thirdly,—The cupola is very costly to keep in repair. Its fabric in contact with the fire, is fast destroyed, thus incurring a perpetual consumption of expensive materials; in addition to which, there is also the wear and tear of machinery. The patent furnace is more durable, and has no machinery to be kept in repair.

Fourthly,—The operations of the cupola are necessarily liable to interruption by the failure of machinery, &c. From this disadvantage the patent furnace is exempt.

Fifthly,—The patent furnace is equally adapted for every situation where atmospheric air can have access to it; whereas, it often happens, that the most convenient place for the cupola is the least convenient for its machinery, so that sometimes the condensed air has to be conducted to a great distance by means of cast iron pipes. At other times there is a difficulty in obtaining the mechanical power, for want of water, &c.

Sixthly,—Although the metal from the cupola, is more suitable for many kinds of castings than that from the reverberatory furnace, having parted with less of its carbon in fusion than the latter, yet reverberatory metal is frequently preferred, when great strength is required. The patent furnace will not only, at all times, produce metal of the same profitable quality as that from the cupola, with the same materials, but it also retains the power of producing it of the same strong quality, as that from the reverberatory furnace, by merely allowing a less proportion of coke to remain on the melted metal whilst in the furnace.

Seventhly,—The coke, and metal, are put into the patent furnace alternately, *stratum super stratum*. As it descends, the metal is thus gradually brought in contact with the greatest heat that is excited in this furnace, as in the cupola. Yet it will generally be found, that the patent furnace will require a less proportion of fuel, to metal, than the cupola. This will be especially the case when a large quantity is melted at one time.

From the foregoing comparisons of the patent furnace with the reverberatory furnace and cupola, many of its great and important advantages as a melting furnace for cast iron, will be readily deduced. Afraid of trespassing too far on the invaluable pages of the Repertory, we have avoided entering so fully into the subject as otherwise might have been desirable. Therefore, the further appropriations of the patent furnace, must be the subject of future communications.

[*Repertory of Patent Inven.*

To THOMAS WALLER, *of Louton, in the County of Bedford, Straw Hat Manufacturer, for his invention of certain improvements in the manufacture of Straw Plait, for the purpose of making Bonnets, Hats, and other articles.*

These improvements in the manufacture of straw plait, for making bonnets, hats, &c. consist in the employment of the ordinary wheat straw grown in Tuscany, and other parts of Italy, instead of English straw, and which is plaited, twisted, or woven in the same manner as English straw, in order to produce similar kinds of straw fabric to those made of English straw, and commonly called or known by the names of whole Dunstable plait; double seven split straw plait; Luton twist plait; broad Luton twist plait; and double eleven split straw plait.

The mode of preparing the Tuscany or Italian straw, (which is not generally known here,) is by pulling the bearded wheat while the ear is in a soft milky state, the corn having been sown very close, and of consequence produced in a thin, short, and dwindled condition. The straw with its ears and roots, is spread out thinly upon the ground in fine hot weather, for three or four days, or more, in order to dry the sap; it is then tied up in bundles, and stacked, for the purpose of enabling the heat of the mow to drive off any remaining moisture. It is important to keep the ends of the straws air tight, in order to retain the pith, and prevent its gummy particles from passing off by evaporation.

After the straw has been about a month in the mow, it is removed to a meadow and spread out, that the dew may act upon it, together with the sun and air, and promote the bleaching, it being necessary frequently to turn the straw while this process is going on. The first process of bleaching being complete, the lower joint and root is pulled from the straw, leaving the upper part fit for use, which is then sorted according to qualities, and after being submitted to the action of steam, for the purpose of extracting its colour, and then to a fumigation of sulphur to complete the bleaching, the straws are in a condition to be plaited or woven into hats and bonnets, and are in that state imported into England in bundles, the dried ears of the wheat, being still on the straw.

The modes of preparing the said straw in Italy, however, forms no part of this invention, it is to be employed in the same state of preparation as when used for weaving, or plaiting that peculiar straw fabric, called Leghorn, and the patentee twists or weaves the said Italian straw, whether whole or split, in the same manner, as is commonly practised by the people in Bedfordshire and its neighbourhood, in making the above-mentioned whole Dunstable plait; double seven split straw plait; Luton twist plait; broad Luton twist plait, and double eleven split straw plait; the methods of making which, the patentee states, are so well understood by straw-plaiters, that any further explanation of the process is perfectly unnecessary.

The advantages of this invention are, that the Italian straw, from

the mode in which it is prepared, is, when so plaited, much stronger than the English straw plait, and when sown together into the forms of hats, bonnets, and other articles, may be readily unsown without injury, and made up again into other forms, suitable to the prevailing fashion or fancy of the wearer; whereas the breadths of Leghorn plait, commonly made from the same materials, being nitted together at their edges, are not capable of being disunited and made up again into other forms.

The specification concludes, by saying—"Having thus stated my improvements, I wish to observe, that I do not profess to be the inventor of any of the several kinds of plait, above-mentioned, but I rest my claim of invention solely in the employment of Italian straw, for the plaiting, twisting, or weaving of similar kinds of fabric, to those heretofore made of English straw, whether whole or split, excepting the English imitations of Leghorn plait: none of the various plaits proposed to be made under this patent, having that sort of selvage, which is capable of being united together, but are all of them so to be plaited, that their edges must be united by sewing, as English straw plait always has been.—*Enrolled August*, 1826.

[*London Jour. of Arts.*

To Benjamin Newmarch, *of Cheltenham, in the County of Gloucester, gentleman, for his having discovered a preparation, to be used either in solution or otherwise, for preventing decay in timber, or other substances, arising from Dry Rot, and other causes.*

This invention, consists in introducing between the fibres of the wood, or into its pores, very minute particles of metallic and other poisonous matters, for the purpose of preventing the growth of vegetable fungi or animalcula. Dry rot in timber, according to the views of the patentee, arises from the decomposition of vegetable fluids, which all kinds of timber contain, and which in certain situations seem to be favourable to the propagation of fungi and of worms; it is also considered that neither animal nor vegetable germination, can proceed in contact with such mineral poisons, as the patentee proposes to employ, and therefore, in order to prevent the premature decay of timber by the growth of vegetable fungi, or of animalcula, the timber is to be treated in the following manner:—

Take one gallon of linseed, or any other kind of oil, (but linseed oil is preferred) and to this, add three ounces of sulphate of copper, or acetate of copper; three ounces of white arsenic; and three ounces of alum. These are to be boiled together, until the minerals are perfectly dissolved, and mixed with the oil. This mixture so prepared in any required quantity, is to be placed in a vessel suitable to receive the pieces of timber, about to be operated upon, which are to be immersed and boiled in the solution for three or four hours, or any other space of time, according to the thickness of the pieces of timber, observing, that they are required to be perfectly saturated with the solution, before they are removed. The pieces of timber having

been thus treated, it is desirable that they should lie immersed in the solution until cold, in order that the pores of the wood may remain completely filled with the oil, and its mineral ingredients; but this is not absolutely indispensable, as the effect of merely boiling the timber in this solution, may be found sufficient to leave the pores filled with the mineral matters.

It is proposed that the mixture should be made in linseed oil, because that appears to be the most effectual solvent, that can be proposed as applicable to timber, as it is well known, that the excessive degree of heat requisite to bring linseed oil to the point of ebullition, exceeds that of almost every other fluid, consequently, the expansion which takes place in the pores of the timber on being boiled therein, together with the total destruction, or chemical change, of all the vegetable, or other corruptible matter, which the wood contained, and the replacing instead of them such antiseptic agents, as the acetic or sulphuric acids, in combination with copper, will entirely prevent the formation of vegetable fungi, or the propagation of animal life. The oxide of arsenic, is likewise known in a great degree to prevent vegetation, and is completely destructive to animal life; and it is also known that these compounds readily combine in solution, and are when incorporated with such an impervious and adhesive agent as boiled linseed oil, rendered indestructible, in most ordinary situations, for any length of time, except when attacked by fire. The alum likewise is calculated to take up that partial kind of moisture which may be floating in the surrounding atmosphere, but its presence may be dispensed with, when the timbers are likely to be immersed in water.

The patentee states, that though he mentions the proportions in which he prefers to mix the several ingredients above named, yet he wishes it to be understood, that he does not confine himself to the use of those exact proportions, but only mentions them as the best that he at present knows of, to effect the object; and though he has described those minerals, as entering into solution with the oil, yet he does not mean to confine himself strictly to the term solution chemically considered, as the said minerals may be blended or mixed with the oil, in a manner that would answer the purpose without absolutely entering into solution: that is, the said ingredients may be mixed by grinding, and be applied to wood in the nature of paint.

The patentee further recommends the employment of charcoal in various situations, for the prevention of dry rot in timber, by introducing it in a dry state, between confined timbers, where the circulation of air is impeded, especially between the plankings of the decks of ships, and in various other situations, as charcoal would be found particularly beneficial on ship board, from its antiseptic and purifying qualities, and in conclusion says; "I wish it to be understood, that I claim as my invention the above preparation and process for preventing the destructive effects of dry rot, and worm on timber, (viz.) the boiling of timber in oil, which has been impregnated with the mineral substances above named, and which preparation may be also usefully employed in preventing decay in various other substances beside wood."—*Enrolled Aug.* 1826. [*Ib.*

To GEORGE AUGUSTUS LAMB, *of Rye, in the County of Sussex, Doctor of Divinity, for his invention of a new composition of Malt and Hops.*

The patentee proposes to make an extract from malt, and hops, which shall contain, not only the saccharine and bitter parts of the ingredients, but also the essential oil of the hops, and retain the flavour so as to be capable by the addition of water and yest, of being fermented into beer.

The mode of making this extract, is, by infusing the hops in warm water, in the proportion of one pound of hops, to two gallons of water, and then submitting this infusion to the process of distillation, so as to obtain the essential oil of the hops, which will be produced in the proportion of about three ounces of the essential oil, from fifty pounds of good hops. After this has been done, the remaining liquor is to be strained off from the hops, by pressure, and the extract thus obtained, evaporated, until fifty pounds weight is reduced to fifteen, and when perfectly cold, three ounces of the essential oil of the hops, is to be mixed with fifteen pounds of the evaporated extract.

The malt is to be submitted to infusion, in the usual way, and the extract obtained, evaporated, until the produce of one bushel of good malt, shall be reduced to twenty-three pounds. When cold, the two extracts prepared as above described, are to be mixed together, in an earthen or wooden vessel, in the proportion of one thousand, one hundred and fifty pounds weight, of the evaporated extract of malt, to fifteen pounds of the compound extract of hops; or if intended to be sent to sea, twenty-two pounds of the extract of hops, are to be mixed with the above-mentioned quantity of the malt extract.

This mixture may be kept in stone jars or bottles, carefully excluded from the air, and may be fermented into beer, as occasion shall require, by the addition of small quantities of yest. For small beer, one pound of the mixed extract, should be incorporated with one gallon of water; for table ale, one pound and a half must be employed, and for strong ale, two pounds of the extract, to the same quantity of water. In summer time, water at the natural temperature, may be used, but, when the weather is cold, the water should not be below 72° Fah.—*Enrolled Aug.* 1825. [*Ib.*

FRENCH PATENTS.

Brevet, for five years, granted to M. LE COFFRE, *for pressing rollers of leather, without seams, for the use of cotton-spinning factories.* Dated April 21, 1818.

The leather employed for making these rollers, is either neats or calf-skin, tanned and passed through oil, to make it more flexible and elastic.

Circles of this leather are cut out by a double punch, and run upon an iron axle of an octagonal form, where they are strongly pressed together between two disks of metal, one of which is soldered to the axle, and the other, which is a screw or nut, may be screwed tighter, or unscrewed, as desired. These rollers are then turned, and reduced to a convenient diameter.

It will be perceived on examining p. 265 of the second volume of our present series, that the rollers which Mr. Philip Chell uses in his patent spinning machinery, and the right to which he expressly claims as being one of his inventions, are precisely made as those above described.

But though M. Coffre has anticipated Mr. Chell five years in the invention, this having been done in a foreign country cannot by itself invalidate the claim of the latter gentleman; and from the circumstance of the account of M. Coffre's brevet not having been published in France before last year (1825,) we think it very probable that Mr. Chell never heard of M. Coffre's invention, and that the same contrivance may have actually occurred to both; a matter not so unfrequent among ingenious persons as many suppose.

[*Repertory of Patent Inven.*

Brevet, for five years, granted to MADEMOISELLE JULIE MANCEAU, *of Paris, for a process for making with raw silk, hats imitating the Italian (or Leghorn) straw hats.* Dated April 16, 1818.

The raw silk, being chosen of the finest quality, is to be first formed into narrow flat pieces (like very narrow tape,) and dyed; and the dyer is to gum them so that they may have a stiffness approaching that of straw or the bark of a tree; then these narrow pieces are to be plaited by a plaiting machine, into bands more or less fine, and more or less close, according to the fineness which is desired to be given to the hats. The plaited bands, are examined carefully through their whole length, in order to cut out the defective parts, which might injure the evenness of the work.

These plaited bands, thus prepared, are measured, rolled into balls of a convenient quantity, and given to work-people to put them together, which is done with a needle, and silk twist of three filaments, of the same colour as the plait.

The concealment of the sewing, is obtained by fastening the left side of the plait, to the right side of that which has been before put together, in such a manner, that the sewing forming a *zigzag* as much at one side as at the other, will be hidden, at all the points of contact. These hats are made in two pieces, the cap (or crown) and the brim.

The first piece is began at the centre, and the points of connexion

are combined in such a manner that, in proportion as the circumference increases, the spiral which the sewing forms, may be developed and connected together without being puckered. This crown ought to be made of a single piece of plait.

The brim is formed in the same manner; the being accustomed to the sewing will enable the eye to determine the most graceful *contours* and best forms in this work. This part, made likewise of a single piece of plait, is united to the crown in order to be gummed, and along with it, to form the hat.

The gum is composed of ten parts of gum tragacanth, one part of alum, and nine parts of water, which being brought to a state of mixture by heat, the work is plunged into it until it becomes saturated, and then is left to become partially dry, and to be deprived of its excess of moisture so as to be in a fit state for being pressed, and smoothed with a hot iron.

For this purpose according to the form required for the crown, a cylinder, or any other solid of wood is used, composed of several pieces, pierced in the middle by an aperture, for the purpose of receiving a piece of wood of a conical shape. This cylinder being placed within the crown, the pressure of the conical piece passing into the centre of the mould, will determine the tension of the stuff, which is then smoothed with a hot iron, the size and form of which are suitable to those of the object on which it is to be employed.

If instead of raw silk it is preferred to use hair, the hats are to be formed of it in the same manner.

These new hats are lighter than those of Italian straw, and they may be washed, and re-dyed of different colours.

CERTIFICATE OF ADDITIONS.

The first materials, which were raw silk; are to be replaced with hair *(poils d' alés)* which has the advantage of rendering the tissue finer without producing any inequalities, and of affording more agreeable shades of colour.

The hats which were formerly made of two pieces, are at present made of a single piece, by the continuation of one length of plait.

The first sort of stiffening had the inconvenience of leaving spots in drying, which is avoided by employing prepared gum tragacanth; and for the second stiffening, a varnish composed of mastic, in tears, to render the hats water-proof.

The smoothing is performed by a mechanical press, which at the same time that it presses the hats, gives them a gloss which they could not obtain from the iron.

Men's hats may be made by the same process. [*Ibid.*

Antiquity of Steam Vessels.

A work has lately been published in Spain, by one of the secretaries of the king, and printed at the royal press; containing original papers, relating to the voyages of Columbus, which had not previously

been published, and which have been collected with great care, from the ancient archives, and libraries, of Spain.

The following remarkable statement, appears as a note, in the first volume of the work. It will be seen, that it ascribes the invention of the steam-boat to a Spaniard, nearly three hundred years ago. We copy this article, from the last number of the North American Review, the editor of which, has translated it from the original.

Circumstantial as is the account given, we confess, that it appears to us, to have been written since the days of Fulton. "This statement, was communicated to the author, in a letter from *Thomas Gonzales*, dated at Salamanca, the twenty-seventh of August, 1825; and, it would appear, that he had recently consulted the public records, to which he refers."

When these 'public records,' shall appear in an authentic form, their evidence must be admitted, but until then, we shall not be inclined to commence the history of the invention of the steam-boat, so far back as the year 1543.—*Editor.*

'Blasco de Garay, a sea captain, exhibited to the emperor and king, Charles the Fifth, in the year 1543, an engine, by which ships and vessels of the largest size, could be propelled, even in a calm, without the aid of oars or sails.

'Notwithstanding the opposition which this project encountered, the emperor resolved, that an experiment should be made, as in fact it was with success, in the harbour of Barcelona, on the seventeenth of June, 1543.

'Garay never publicly exposed the construction of his engine, but it was observed at the time of the experiment, that it consisted of a large caldron or vessel of boiling water, and a moveable wheel attached to each side of the ship.

'The experiment was made on a ship of two hundred tons, arrived from Colibre, to discharge a cargo of wheat at Barcelona; it was called the Trinity, and the captain's name was Peter de Scarza.

'By order of Charles the Fifth, and the prince, Philip the Second, his son, there were present at the time, Henry de Toledo, the governor Peter Cardona, the treasurer Ravago, the Vice Chancellor Francis Gralla, and many other persons of rank, both Castillians and Catalonians; and among others, several sea captains witnessed the operation, some in the vessel, and others on the shore.

'The emperor and prince, and others with them, applauded the engine, and especially the expertness with which the ship could be tacked. The treasurer, Ravago, an enemy to the project, said it would move two leagues in three hours. It was very complicated and expensive, and exposed to the constant danger of bursting the boiler. The other commissioners affirmed that the vessel could be tacked twice as quick as a galley, served by the common method, and that at its slowest rate, it would move a league in an hour.

'The exhibition being finished, Garay took from the ship his engine, and having deposited the woodwork in the arsenal of Barcelona, kept the rest himself.

'Notwithstanding the difficulties and opposition thrown in the way by Ravago, the invention was approved, and if the expedition, in which Charles the Fifth was then engaged, had not failed, it would undoubtedly have been favoured by him. As it was, he raised Garay to a higher station, gave him a sum of money (200,000 maravedies) as a present, ordered all the expenses of the experiment to be paid out of the general treasury, and conferred upon him other rewards.

'Such are the facts collected from the original registers, preserved in the royal archives at Samáncas, among the public papers of Catalonia, and those of the secretary at war, for the year 1543.'

ON ENGRAVING.

(From the Mechanics' Gallery. By C. F. Partington.)

(Continued from page 204.)

On Aqua tinta.

Aqua tinta, is a method of producing prints, very much resembling drawings in Indian ink.

The principle of the process, consists in corroding the copper with aqua fortis, in such a manner, that an impression from it, has the appearance of a tint laid on the paper. This is effected, by covering the copper with a powder, or some substance, which takes a granulated form, so as to prevent the aqua fortis from acting where the particles adhere, and by this means, causes it to corrode the copper partially, and in the interstices only. When these particles are extremely minute, and near to each other, the impression from the plate, appears to the naked eye, exactly like a wash of Indian ink; but, when they are larger, the granulation is more distinct, and as this may be varied at pleasure, it is capable of being adapted with great success, to a variety of purposes and subjects.

This powder, or granulation, is called the *aqua tinta grain*, and there are two general modes of producing it.

We shall first describe what is called the *powder-grain*, because it was the first that was used.

Having etched the outline on a copper-plate, prepared in the usual way by the coppersmith, some substance must be finally powdered and sifted, which will melt with heat, and when cold, will adhere to the plate, and resist the action of aqua fortis. The substances which have been used for this purpose, either separately or mixed, are, *asphaltum, Burgundy pitch, rosin, gum-copal, gum-mastich*; and, in a greater or less degree, all the resins and gum-resins, will answer the purpose. Common rosin, has been most generally used, and answers tolerably well; though gum-copal makes a grain that resists the aqua fortis better.

The substance, intended to be used for the grain, must now be distributed over the plate as equally as possible; and different methods of performing this essential part of the operation, have been used by different engravers, and at different times.

The most usual way, is to tie up some of the powder in a piece of muslin, and strike it against a piece of stick, held at a considerable height above the plate; by this, the powder that issues, falls gently, and settles equally over the plate. Every one must have observed, how uniformly hair powder settles upon the furniture, after the operations of the hair-dresser. This may afford a hint, towards the best mode of performing this part of the process. The powder must fall upon it from a considerable height, and there must be a sufficiently large cloud of the dust formed. The plate being covered equally over with the dust, or powder, the operator is next to proceed to fix it upon the plate, by heating it gently, so as to melt the particles. This may be effected, by holding under the plate lighted pieces of brown paper, rolled up, and moving them about, till every part of the powder is melted; this will be known by its change of colour, which will turn brownish. It must now be suffered to cool, when it may be examined with a magnifier, and if the grains or particles, appear to be uniformly distributed, it is ready for the next part of the process.

The design or drawing to be engraved, must now be examined, and such parts of it as are perfectly white, are to be re-marked. Those corresponding parts of the plate, must be covered, or stopped-out, as it is called, with turpentine-varnish, diluted with turpentine to a proper consistence, to work freely with the pencil, and mixed with lamp-black, to give it colour; for if transparent, the touches of the pencil would not be so distinctly seen. The margin of the plate, must also be covered with varnish. When the stopping-out is sufficiently dry, a border of wax must be raised round the plate, in the same manner as in etching, and the aqua fortis properly diluted with water poured on. This is called biting-in, and is the part of the process, which is most uncertain, and which requires the greatest degree of experience. When the aqua fortis has lain on so long, that the plate, when printed, would produce the lightest tint in the drawing, it is poured off, and the plate washed with water, and dried. When it is quite dry, the lightest tints in the drawing, are stopped out, and the aqua fortis poured on as before, and the same process is repeated as often as there are tints to be produced in the plate.

Although many plates are etched entirely by this method of stopping-out and biting-in alternately, yet it may easily be conceived, that in general, it would be very difficult to stop round, and leave out all the finishing touches, as also the leaves of trees, and many other objects, which it would be impossible to execute, with the necessary degree of freedom in this manner.

To overcome this difficulty, another very ingenious process has been invented, by which these touches are laid on the plate with the same ease and expedition, as they are in a drawing of Indian ink. Fine washed whiting, is mixed with a little treacle or sugar, and diluted with water in the pencil, so as to work freely, and this is laid on the plate, covered with the aqua tint ground, in the same manner, and on the same parts as ink on the drawing. When this is dry, the whole plate is varnished over, with a weak and thin varnish of turpen-

tine, asphaltum, or mastich, and then suffered to dry, when the aqua fortis is poured on. The varnish will immediately break up in the parts, where the treacle mixture was laid, and expose all those places to the action of the acid, while the rest of the plate, remains secure. The effect of this will be, that all the touches or places, where the treacle was used, will be bit-in deeper than the rest, and will have all the precision and firmness of touches in Indian ink.

After the plate is completely bit-in, the bordering wax is taken off, by heating the plate a little with a lighted piece of paper; and it is then cleared from the ground and varnish by oil of turpentine, and wiped clean with a rag, and a little fine whiting, when it is ready for the printer.

The principal disadvantages of this method of aqua-tinting, are, that it is extremely difficult, to produce the required degree of coarseness or fineness in the grain, and that plates so engraved, do not print many impressions before they are worn out. It is therefore now very seldom used, though it is occasionally of service.

We next proceed to describe the second method of producing the aqua tint ground, which is generally practised. Some resinous substance is dissolved in spirits of wine, as common rosin, Burgundy-pitch, or mastich, and this solution is poured all over the plate, which is then held in a slanting direction, till the superfluous fluid drains off; and it is laid down to dry, which it does in a few minutes. If the plate be then examined with the magnifier, it will be found, that the spirit, in evaporating, has left the resin in a granulated state, or rather, that the latter has cracked in every direction, still adhering firmly to the copper.

A grain is thus produced with the greatest ease, which is extremely regular and beautiful, and much superior for most purposes, to that produced by the former method. After the grain is formed, every part of the process is conducted in the same manner, as above described.

(TO BE CONTINUED.)

ESSAYS ON BLEACHING.

By James Rennie, A. M. Lecturer on Philosophy, &c. &c. London.

No. 1.—HISTORY OF THE ART.

SECTION III.—A still greater improvement in this art, was made between twenty and thirty years subsequent to Dr. Home's publication, on the application of chlorine to bleaching. The manufacturer is indebted to the distinguished French chemist, Berthollet, for the addition of so important and powerful an agent to his apparatus. This substance was discovered by Scheele, in 1774. Its property of destroying vegetable colours, was soon after ascertained by the illustrious discoverer, and detailed experiments on this property, were given by him in the Transactions of the Swedish Academy of Sciences, of which papers of Scheele, we have a translation by Dr. Bed-

does. This property, excited a lively interest among the chemists of the day, and gave rise to many ingenious experiments, besides those of Scheele, most of which, appeared to be more amusing to philosophic curiosity, than useful, in the advancement of so important an art as bleaching. But such experimental amusements, are seldom destitute of utility, and important results, even though at first sight, they may appear to be fanciful or trifling. The wild dreams of the Alchymists, laid the foundation of the most interesting of the sciences, and lighted a torch, which the splendid discoveries of our contemporaries, have kindled to a blaze; the speculative experiments, which were made on chlorine, merely to gratify a passion for chemical research, have been turned to advantageous account, in an important branch of our manufactures. It was no less than ten years after the discoveries of Scheele, that chlorine was applied to practical bleaching. The first account of this application is given by Berthollet, in the Journal de Physique, for 1785, and in the Annales de Chemie, tome I. From the details there given, and from papers published by the same chemist, in the years immediately succeeding, we learn that the mode of bleaching by chlorine, was carried on to a considerable extent in various parts of France.*

The history of the introduction of Berthollet's method into Britain, has given rise to some disputes, which I think it of some importance, though of some difficulty, to settle. Parkes states, on the authority of Professor Copland of Aberdeen, and the present Duke of Gordon, that, when travelling on the Continent, they learned the process from Saussure of Geneva. The Professor, foreseeing the advantage which his countrymen would derive from a knowledge of this, made himself master of the requisite manipulations, and immediately on his return, communicated the important information to several bleachers at Aberdeen. This was so early as July, 1787, but two years subsequent to the invention of the method. The Aberdeen bleachers, first used a Woolfe's apparatus, but the inconvenience of glass vessels, in extensive works, obliged them to have recourse to those made of white wood. This seems to have been the first introduction of Berthollet's method into Britain. It was not till the following year, that Mr. Watt of Birmingham, was instructed by Berthollet himself in the art, which, without impropriety, might then be called new, so complete was the revolution caused by this useful invention.† Mr. Watt was

* It is somewhat ridiculous, to observe it stated in Rees' Cyclopedia, (Art. Bleaching,) that the first practical application of chlorine, was made in the Spring of 1788, in London, at the suggestion of Dr. Kirwan, who had learned the decolourizing property of the substance, directly from Scheele.

† Since the publication of Mr. Parkes' Essays, however, this statement has been corrected by Dr. Henry, in a letter to Dr. Thomson, dated Oct. 1815. From this it appears, that Mr. Watt was acquainted with Berthollet's discoveries, so early as the beginning of 1787, as he expresly says in a letter, dated Feb. 23, 1788, "I have, *for more than a twelvemonth*, been in possession and *practice* of a method of preparing a liquor from common salt, which possesses bleaching qualities in an eminent degree; the inventor is an eminent chemist and philosopher at Paris." (Ann. Phil. VI. 423, in a note.) This, therefore, must have been several months prior to the commencement of the works at Aberdeen.

impressed with the importance of the improvement, entered upon experiments with all the enthusiasm of genius, and actually applied it to practice, by bleaching 1500 pieces of cloth, a circumstance, which he mentions in the above-mentioned letter: but he did not persevere in the practice of the art, owing, most probably, to his local distance from the seat of the cotton and linen manufactories. But the knowledge of the process, which had been acquired by Mr. Watt, was not lost. He communicated a portion of his own enthusiasm to several scientific and enterprising persons about Manchester, who entered with keenness, and alacrity, upon the practice of bleaching by chlorine. In Rees' Cyclopedia, it is said, that the Manchester bleachers, as well as Mr. Watt, received their information from Kirwan, who is there said to be the original suggestor. Be this as it may, the year 1788 had not elapsed, when Dr. Taylor, and Mr. Cooper of Manchester, bleached, for the purpose of experiment, a piece of cotton goods by this process, had it printed, calendered, and fit for the market, in less than three days. Exulting in the success of his experiment, Mr. Cooper, together with several other enterprising manufacturers, commenced a bleaching work at Raikes, near Bolton, where Berthollet's discovery was applied, on a very extensive scale. We are informed by Mr. Parkes, that, in these works, there is at present (1815) consumed many tons of sulphuric acid every week. Mr. Henry of Manchester, not only formed a similar establishment, which his increasing practice in medicine, and the dishonourable conduct of a partner, obliged him to abandon, but generously instructed the principal bleachers in this country in the method, of which, at this period, there was no practical account published. The method of Mr. Henry at first consisted, sometimes of immersing the goods in a watery solution of the gas, or in an alkaline ley impregnated with it; and sometimes in exposing the goods, previously moistened with water, to the action of the gas itself. Soon afterwards, he made a farther improvement, in substituting lime for alkali, as a means of condensing the gaseous chlorine, which was exclusively applied to white goods. An air-tight chamber was constructed, on the floor of which, was spread a stratum of lime, mixed with water to the consistence of cream. Through this, the goods were passed by means of a wince, and the chamber being filled with gas, the goods were exposed alternately to the calcareous liquid, and the acid vapours. An oxymuriate of lime was thus formed on the surface of the cloth, which, after the operation had continued for a sufficient length of time, was taken out, and exposed to the usual processes of washing, crofting, and finishing.

Early in the year 1788, an attempt was made in England by some foreigners, De Bonnevil & Co. who had modified the plan of Berthollet, to obtain a parliamentary grant for the discovery of a new method of bleaching; and failing in this, to obtain a patent right for their pretended discovery. Mr. Watt, however, who had previously been made acquainted with Berthollet's discovery, resisted this monopoly, and was joined by Mr. Cooper and Mr. Henry, whose successful experiments, we have already mentioned. An opposition from so respectable a quarter, was effectual, and the foreigners were

foiled in their attempt to obtain a grant. Mr. Henry, individually, presented a legal petition in due form, against the patent, and was successful in opposing it. His petition, dated July 2, 1788, contains every thing at present known, relative to bleaching, except the condensation of chlorine by means of lime, a thing which he afterwards accomplished, (see Ann. Phil. VI. 424.) The agent, which these foreigners employed in their process, they called Liqueur de Janelle, from the name of their native place. It was prepared by receiving the gas, which arises from the distillation of three pounds of muriate of soda, and one pound of manganese, into a receiver, containing one pound of the best American pearl ash, dissolved in four pounds of water. For the purpose of extricating the gas from these materials, two pounds of sulphuric acid, diluted with four pounds of water, were held to be sufficient. I am not quite sure if the inventors of this liquid, have received all the praise which is due to them. It is certain, that they did not learn the process from Berthollet, as he only found it out by analyzing the liquid prepared by them.

Next year, 1789, Berthollet published in the Annales de Chemie, a very circumstantial account of the system, with ample directions for the construction of the apparatus. From this it appears, that gas bleaching, was now adopted in various parts of France, and would have been universally employed, but for want of a convenient, and safe mode, for its production, and application. These obstacles, Berthollet subsequently overcame by the most ingenious inventions of apparatus, of which he has published an account in the Annales de Chemie. Previous to this, gas bleaching was conducted in England, upon a very imperfect method, and the manufacturers were ignorant of any other mode of using the chlorine, except in the gaseous state. At Nottingham, for instance, small parcels of linen yarn, linen and cotton hose, and the like, were bleached by being suspended within large wooden boxes, each of which had a close bottom, capable of holding water. Into these, gas was conveyed, and, to prevent any injury by its immediate application, the goods were, by means of a frame and pulley, frequently let down into the water at the bottom; by which method, it was difficult to get all the surfaces of the goods equally exposed, without which, bleaching must always be imperfect. This mode, however, was ingeniously improved by Mr. Rupp, of Manchester, who has given a plate, and a description of his apparatus, in the 5th vol. of the Manchester Memoirs.

(TO BE CONTINUED.)

ANCIENT VASES.

(Continued from page 226.)

From an accurate examination, it appears probable that the thin pellucid coating, by which the colour of the clay is rendered brighter, or duller, is of the same substance with the black paint of vases, but in a diluted or attenuated state, which was first shown by the cele-

brated Jorio, the very learned Inspector of the Royal Collection of Vases at Naples. It may commonly be observed in vases, that this paint has been repeatedly applied, where the colour of the clay had not been completely modified by the first operation, and in this manner also the colour has been changed from dusky, to black. Sometimes single lines occur, in which different degrees of intensity may be observed in the colour.

We shall now inquire into the nature of this black paint. Caylus has ascribed the black varnish to the martial or manganesian earth of glass-works, an opinion which Grivaud has also embraced. Le Sage once thought, that the black coating of vases, was produced from oxide of lead, and oxide of manganese, which opinion is not only sufficiently confuted by what I have said above, with regard to the nature of the varnish. but also by the slight degree of baking which the vases have undergone, by which the oxide of lead could not be applied, as Chaptal has also remarked. Scheerer says, that the coating of vases does not consist of metallic substances, but of a certain kind of earth, and that the black colour cannot have been produced by oxide of manganese. Chaptal inclines to the opinion, that vitreous lava has formed the basis of the coating of vases, its natural fusion having been strongly assisted, by the addition of some saline substances. Vauquelin was the first who discovered that the black paint was carbonaceous, and he is at the same time of opinion, that it was prepared from graphite or anthracite.

From experiments made with the view of investigating this matter, I too have found that the black coating of vases consists of a combustible substance, either carbonaceous or bituminous; with this determination, the above-mentioned experiments also agree, inasmuch as it is not dissolved by acids. On throwing particles of the black coating, into nitre, fused in a platina cup, they burned by sparkling, and were quickly consumed. By this experiment, the singular phenomenon, that a coating so thin should have preserved its colour, and lustre, for so long a period, is satisfactorily explained.

The question, regarding the substance from which this black coating has been derived, is more difficult of solution. I cannot give my assent to the opinion of the celebrated Vauquelin, mentioned above. It is shown, by the colour and lustre of the paint, that it could not have been prepared from graphite, a substance which has more of the colour of iron, and a metallic lustre. The quality which it possesses of fusing with nitre, as above related, is also against its derivation from graphite and anthracite. If we suppose the paint to have been laid on with a pencil, it may be inferred that its substance had been fluid of itself, or had been reduced to a state of fluidity, by means of some other substance. As the appearance of the coating of vases proves its fusion, it may be concluded that the matter was either fusible of itself, or had been rendered so, by intermixture with some other substance. Nor does it seem improbable, that, in order to form this coating, a substance was applied, which either occurred in the different countries in which those vases were manufactured, or was easily procured by commerce.

I instituted various experiments, with the view of determining this substance, which entirely failed, because I followed the common opinion, that the black coating of the antique vases, was laid on, and burnt in, in the same way as the pigments are, in the manufacture of our better sorts of earthen-ware. I applied various carbonaceous substances, vegetable as well as mineral, reduced to a sufficient degree of tenuity by levigation, either by themselves, or by means of a fluid, or mixed with fusible substances, to vessels either dried in the air, or baked, and these I exposed, after inclosing them in other vessels, to various degrees of heat, in a pottery-furnace. These vessels so coated, came, without exception, from the furnace, with red, yellow or white colours, according to the quality of the clay, and the different degrees of heat. I applied liquid bitumen in other experiments, but with no better success.

When I had almost despaired of accomplishing my object, it occurred to me, that perhaps the method which is used for covering iron-work with a black coating, might be equally applied to earthen-ware. The experiments, in which I made use of mineral bitumen, succeeded very well. I dissolved asphaltum in naphtha or mineral oil, and applied the solution, by means of a pencil, to earthen vessels once baked and again heated, by which a black coating, like varnish, intimately attached to the surface of the vessels, and precisely similar in appearance to the black coating of the ancient Grecian vases, was immediately produced. The degree of heat at which the solution is to be applied, should be such as is sufficient for melting the asphaltum. I exposed the vessels, after the coating was laid on, for some time to heat, by which the naphtha is evaporated, and the varnish is completely dried. Liquid bitumen, applied in the same manner, gives a similar, but less bright, varnish. The solution of asphaltum by means of naphtha, is also preferable on this account, that very different degrees of saturation may be produced. A thin solution, affords a transparent varnish, by which dusky colours are produced, passing more or less into red, according to the different colour of the clay. If the application of this solution be repeated, very different varieties of varnish may be produced, from a brown colour, to a perfect black. If a saturated solution be applied, a dull black colour is produced, at once.

In the same way that the surface of vessels is covered over with varnish, various figures are painted upon it, by means of a pencil. The paintings may be made more perfect, in proportion to the degree of heating, which the vessel undergoes; for the varnish enters in this manner, the sooner into the pores of the clay, and loses its fluidity, on which account the delineations are more distinct. But the more the vessels are heated, the more quickly must the paintings be applied.

As it is only the outside that requires to be covered with varnish, or paintings, vessels may easily be heated for this purpose, by filling them with burning charcoal, or hot embers. But if vessels having little depth, are to be painted within, they must be previously heated in a proper furnace, or among hot cinders.

(TO BE CONTINUED.)

FOR THE FRANKLIN JOURNAL.

Description of a new Scale and Protracter, invented by M. Twitchell.

The editor of the Franklin Journal, will oblige me, by inserting the following description of my scale and protracter.

This instrument consists of a circle, marked with the lines of sines, tangents, secants, semitangents, and chords; to the centre of which circle, is annexed a scale of the shape of half a cross, agreeing with the line of chords on the circle, and marked on each limb, with the line of equal parts; the cross limb of this scale, consists of two parts; to one of which is annexed a semicircle, marked with the line of chords, the other part, turning on its centre, and agreeing with the line of chords on the semicircle, serving both as a protracter and scale. To the centre of the whole circle, is annexed, a small limb, agreeing with the line of chords on the circle, and extending over the scale, and serving as a secant to the circle. This scale, exhibits the use of chords, sines, secants, and tangents, and the mode of applying them to angles, giving the sides, and chords, of any triangle, and also, its sine, tangent, and secant; and likewise, latitude, departure, course, and distance. For drafting, this scale is particularly useful; for in plotting, nothing more is required, than to turn the scale to the course, and mark the distance.

Among the numerous recommendations received, are those of B. Hallowell, and C. Farquhar, principals of Alexandria boarding-school; James D. Woodside, math. prof.; William Thornton, of the patent office; John M. Moore, of the gen. land-office; C. Schwartz, draftsman of the navy board; brig. gen. Bernard, of the board of engineers, and William Strickland, civil engineer.

MARK TWITCHELL.

The editor has examined the instrument above named, and is of opinion, that in addition to the purposes indicated, it would be found particularly useful in teaching trigonometry, as it renders the relationship of the angles, objects of sense.

List of New Patents, in England, which have passed the Great Seal since July 24, 1826.

James Barron, for a combination of machinery or apparatus for feeding fire with fuel, which machinery or apparatus is applicable to other purposes. Dated July 24, 1826.

William Johnston, for improvements on ink-holders. Dated July 24, 1826.

William Robinson, for a new method of propelling vessels by steam on canals or navigable rivers, by means of a moveable apparatus attached to the stem or stern of the vessel. Dated July 24, 1826.

William Parsons, naval architect, for improvements in building ships or vessels, which improvements are calculated to lessen the dangerous effects of internal or external violence. Dated July 24, 1826.

William Davidson, Glasgow, for processes for bleaching or whitening bees' wax, myrtle wax, and animal tallow. Dated August 1, 1826.

Thomas John Knowlys, Esq. and William Duesbury, collar manufacturer, for improvements in tanning. Dated August 1, 1826.

Count Adolphe Eugene de Rosen, for a new engine for communicating power to answer the purposes of a steam-engine. Communicated by a foreigner. Dated August 1, 1826.

Joseph Browne Wilks, Esq., for improvements in producing steam for steam-engines, and other purposes. Dated August 2, 1826.

Lemuel Wellman Wright, engineer, for improvements in the construction of trucks or carriages, applicable to useful purposes. Dated August 2, 1826.

John Williams, and John Doyle, for an apparatus and process for separating salt from sea water, and thereby rendering it fresh and fit for use. Dated August 4, 1826.

Erskine Hazard, of North America, but now residing in Norfolk-Street, Strand, engineer, for a method or methods of preparing explosive mixtures, and employing them as a moving power for machinery. Partly communicated to him by a foreigner. Dated August 12, 1826.

John Thomas Thompson, camp-equipage-maker, for improvements in making or manufacturing metallic tubes, whereby strength and lightness are obtained, and for applying them, with various other improvements, to the constructing of the metallic tube, and other bedsteads. Dated August 17, 1826.

List of Patents issued in the United States, from the 2nd to the 30th of Aug. 1826.

To James Barron, of Virginia, for an improvement, denominated the carrying and lifting dock; for building and repairing vessels, August 2nd.

To Henry Bostwick, of New York, for a method of representing by lines, consistent with a scale of time, the kindred, genealogy, chronology, and succession of persons, distinguished in history or fable, August 2nd.

To Cotton Foss, of Ohio, for the application of steam, to the blast of furnaces; called a steam power furnace, August 2nd.

To Elisha Crowell, of Maine, for a method of moving the trip hammer, August 4th.

To H. Branch, of New York, for a mode of turning any number of augers, centre-bits, &c. in making mortices of any dimensions or proportions, August 7th.

To John A. Smith of Connecticut, for an improved mode of elevating liquors, from a lower to an upper room, August 7th.

To Z. S. Holdridge, and H. S. Lawson, of New York, for an improvement in the plough, August 9th.

To S. Lehman, of Philadelphia, for an improvement in the fire-ladder, August 9th.

To J. Hines, and W. Bain, of New York, for dressing flax, or hemp, rolled, or unrolled, August 12th.

To Joseph H. Laning, of Tennessee, for a method of working steam, twice over, or working two steam-engines, with the same steam, August 12th.

To Joseph Hastings, of Massachusetts, for a method of making lamp-black, August 15th.

To Joseph Clarkson, of Baltimore, for a machine for laying, and twisting cotton, and other cords, August 16th.

To Thomas Van Riper, of New Jersey, for a trussel bobbin, or spool, to be used in spinning factories, August 16th.

To Joseph Eve, of England, for an improvement in steam-enginery, August 16th.

To William Burton, of New York, for a machine for washing clothing, or cloth, August 16th.

To Joseph H. Schreiner, of Philadelphia, for an improved auger, August 17th.

To John Floyd, of Maine, for a floating dry-dock, called Floyd's floating machine, for lifting ships, or vessels out of the water, for the purpose of repairing them, August 19th.

To Benjamin Wilse, of New York, for improved suspenders, August 19th.

To Z. Parkhurst, of Massachusetts, for a substitute for oil, and which may be mixed with oil in proper proportions, and applied to wool, before carding, August 19th.

To Joseph H. Schreiner, of Philadelphia, for a mode of setting saws, August 19th.

To J. R. Wheeler, and J. B. Wheeler, of New York, for a machine for roping and spinning wool and cotton, August 28th.

To William H. Cantelo, and Robert M. Kerrison, of New York, for a *Jubilee Stock*, August 30th.

NOTICES.

FRANKLIN INSTITUTE.

Lithography.—A communication has appeared in the Boston Commercial Gazette, in which it is stated, that Messrs. J. & W. Pendleton, of that city, to whom the Silver Medal of the Institute, was awarded, for the best specimen of LITHOGRAPHY, are only *lithographic printers*, and not artists. As the Institute has not heretofore demanded certificates of origin, with articles deposited, such an error may have been committed; but we doubt not, that measures will be taken, to prevent the recurrence of a similar event. Of the correctness of the above statement, we have not any other information, than that which appears in the communication, to which we have alluded.

Auger for boring square holes.—It is now said, that Mr. H. Branch, of New York, is not the inventor of this auger; he however, represented himself as such, to the committee on inventions, whose report on this instrument, is in our last number. It is also said, that Mr. Cyrus Jenkins is "the true inventor," and that Mr. Branch, has a third rate right, by purchase, and that he has since obtained a patent, for "turning any number of augers" at once. We have neither time, or inclination, to enquire into the validity of such claims, we however, wish "honour, to whom honour" is due. We think, that some of our *patent-mongers*, give a very broad construction to the words "true inventor."

To Subscribers.—The subscription for this Journal, was due on the 1st of June; but few of our country subscribers have paid, and many in town are in arrears. Our number for December, will not be forwarded, until the amount due is paid. In future, payment must be made in advance, by those who live at a distance.